FINAL ENVIRONMENTAL IMPACT STATEMENT

STILLWATER MINING COMPANY

UNDERGROUND VALLEY CROSSING and MINE PLAN

Application to Amend Plan of Operations, Permit No. 00118

Prepared by

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

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EXECUTIVE SUMMARY

On April 7, 1995, the Department of Environmental Quality (DEQ) received an application to amend operating permit no. 00118 from Stillwater Mining Company (SMC). This proposed amendment to the permit addresses SMC's wish to connect the East and West mining areas by way of a haulage drift located at the 4400 foot level. The haulage way would be developed beneath the Stillwater River and its flood plain. SMC proposes to connect mining operations on both sides of the Stillwater River Valley through construction of an underground haulage level at the 4400 foot elevation.

The purpose of this Amendment to Stillwater Mining Company's Plan of Operation is to provide an underground connection between the East and West mining areas. This would be via a haulage drift driven on the 4400 level, developed in part under the Stillwater River. SMC may, upon approval of the plan, mine the ore body at and below the 4400 level if and when mineralization is defined.

The approval of this Amendment would provide SMC with the means to reduce ore and waste handling costs while increasing the ore reserves available for mining. SMC plans to implement this Amendment in two distinct phases. Phase I would include completion of the 4400 haulage level and the diamond drilling necessary to define the mineralization. Phase II would involve implementation of the mining plan below the surface crown pillar. Approval of this Amendment would allow SMC to reduce ore and waste handling costs by shortening haulage distances to the mill, and enable SMC to crush the ore prior to reaching the mill, to access and further delineate additional ore reserves, and to reduce conflict with recreational traffic using County Road 419.

The stability analysis indicates that the proposed crown pillar thickness (200 ft) is adequate. The long-term stability of the pillar is not considered to be an issue, particularly because SMC proposes to backfill the 4400 haulageway level at closure where it is adjacent to the base of the crown pillar. In addition all stopes would be backfilled upon completion of mining.

Inflows to the proposed 4400 haulage level are expected to be through bedrock fractures. These fractures may have some connection to the overlying alluvium, but their low permeability would limit the inflow volumes. Inflows from these features are expected to be on the same scale as the flows currently observed in the East Side Mine. The predicted rate of the inflow to the haulageway (200 gpm) is not expected to have any impact on flow in the Stillwater River or groundwater levels in the valley.

Groundwater and surface water quality are not expected to change following the implementation of this proposal. Mine production rates and the associated nutrient loading from mining activities would not be increased by way of this amendment and would not exceed the levels analyzed in the SMC 2000 TPD EIS.

TABLE OF CONTENTS

FIGURES

TABLES

CHAPTER I PURPOSE AND NEED FOR ACTION

This final Environmental Impact Statement (EIS) discloses the direct, indirect, and cumulative impacts of the proposed underground development and alternatives to the proposed development. The purpose and need for the project; EIS process; public participation; agency roles, responsibilities and decisions; and the identification of issues pertaining to the project are also described in this chapter. A small glossary is at the back of this document to assist readers with more technical terms.

PROPOSED ACTION

On April 7, 1995, the Department of Environmental Quality (DEQ) received an application to amend operating permit no. 00118 from Stillwater Mining Company (SMC) (SMC, 1995). Under this proposed amendment to the permit, SMC proposes to connect mining operations on both sides of the Stillwater River Valley through construction of an underground haulage level at the 4400 foot elevation and to mine additional reserves below the haulageway. The haulageway would be developed beneath the Stillwater River and its flood plain. This amendment to the operating permit has been submitted as an appendix (Appendix H) and supplemental pages to the 2000 TPD Plan of Operations approved September 23, 1992.

PURPOSE AND NEED

Approval of this amendment would allow SMC to reduce ore and waste handling costs by shortening haulage distances to the mill and by crushing the ore prior to reaching the mill, would enable SMC to further delineate and mine additional ore reserves using the existing mine infrastructure, and would reduce potential future conflicts with recreational traffic using County Road 419.

PROJECT LOCATION AND BACKGROUND

The Stillwater Mining Company (SMC) operates an underground platinum/palladium mine in Stillwater County, Montana (Figure 1). The closest community is Nye, approximately 5 miles northeast of the mine site. Mine employment would peak at 525 employees under existing permits.

SMC has been permitted to operate the mine with an ore production rate averaging 730,000 tons per year (TPY), or 2,000 tons per day (TPD). Currently, ore production rates are 1,050 TPD. The ore is upgraded on site by crushing, grinding, floating, and drying to a concentrate. The crushing facilities are currently located on the surface (Figure 2).

The tailings impoundment is permitted to hold 3.5 million tons of tails and is expected to reach capacity in approximately 2003. Approximately 57 percent of tailings created during the milling process is returned underground for use as backfill in mined out stopes. The remaining 43 percent is disposed of in a lined tailings impoundment adjacent to the mine and mill facility. The dried concentrate is shipped by truck to a smelter located in Columbus, Montana, for further processing and is subsequently shipped to Belgium for refining.

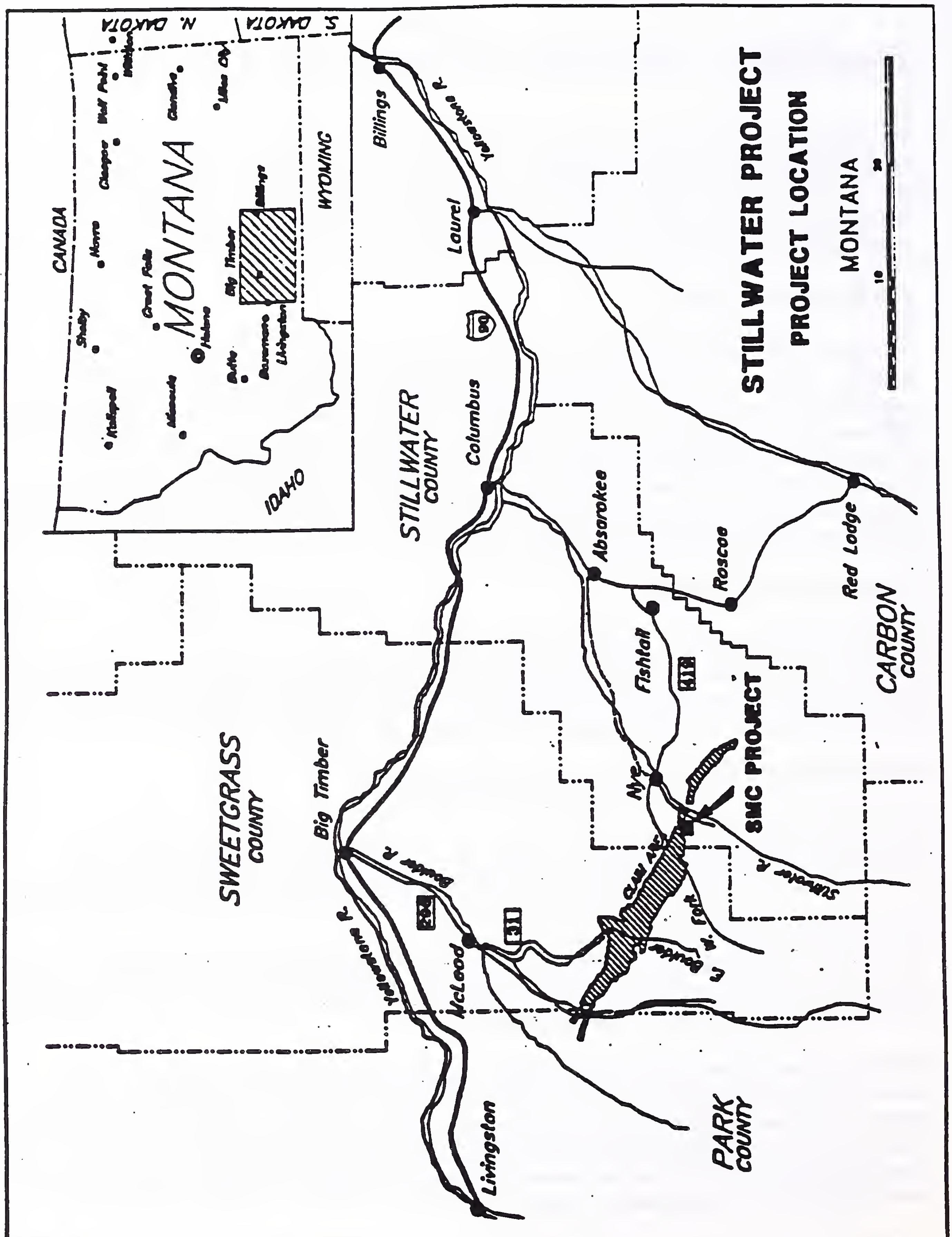
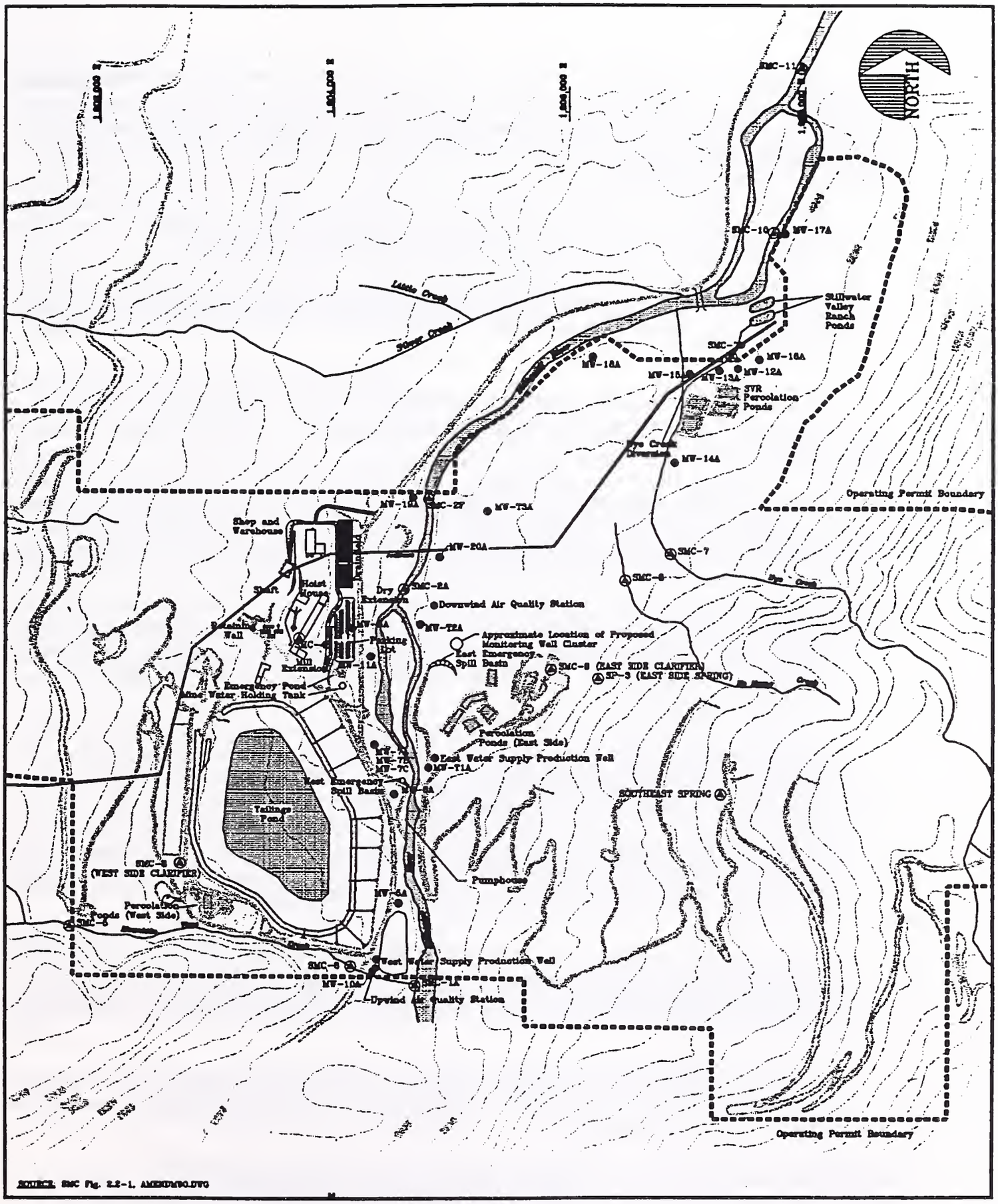


Figure 1 Stillwater Project Location



SCALE
(In Feet)
600 0 600

Legend
SMC-8 Surface Water Monitoring Site
MW-10A Groundwater Monitoring Site

Stillwater Mine Area and Water Resources Monitoring Sites

Underground River Crossing EIS
Stillwater Mining Company

FIGURE 2

SMC's original plan of operations was approved after completion of a Final Environmental Impact Statement (EIS), jointly written by the Montana Department of State Lands and the Custer National Forest (MDSL-USFS, 1985). The current proposal, if approved, would be the ninth amendment to the original plan of operations and permit. The following is a summary of previously approved changes to the plan of operations.

Amendment 001 - Approved and permitted June 30, 1986. This amendment relocated mine and mill facilities. No increase in permit area or disturbed area resulted.

Amendment 002 - Approved and permitted September 8, 1986. This amendment allowed excavation of a sand borrow area in the existing permit area. The disturbed area has been reclaimed.

Amendment 003 - Approved and permitted January 8, 1987. This amendment allowed excavation of a second sand borrow area within the permit area and the disturbance has been reclaimed.

Amendment 004 - Approved and permitted February 24, 1987. This amendment relocated the southern portion of the tailings impoundment toe dike within the permit area. This amendment shifted the toe dike to higher ground along Mountain View Creek on previously disturbed land.

Amendment 005 - Approved and permitted March 2, 1989. This amendment was the first major amendment since the original permit. It increased the permitted area to 1,158 acres and permitted mining on the east side of the Stillwater River. The total allowable disturbance was increased by 72 acres.

Amendment 006 - Approved and permitted July 21, 1989. This amendment was for construction of a temporary sand slurry pipeline connecting the east and west sides of the mine area. No increased permit or disturbed area was allowed.

Amendment 007 - Approved and permitted November 15, 1990. This amendment was for construction of the three Stillwater Valley Ranch percolation ponds and four monitoring wells. The permit area was increased 27 acres with 7 acres of disturbance.

Amendment 008 - Approved and permitted on September 23, 1992. Under this amendment, production was permitted to increase from 1000 tons per day (TPD) to 2000 TPD. Some expansion of support facilities such as waste dumps, the mill, and the tailings impoundment was also approved.

In addition, SMC's minor amendment to relocate the 5900 adit southward onto private land to visually hide it from almost all public view was approved. The permit area was extended by 48 acres with 2 acres disturbed.

Currently the total permit area is 1,233 acres with 245 acres permitted for disturbance. However, because of ongoing reclamation and staged development, only 117 acres are currently disturbed. MDSL-USFS, 1985; MDSL-USFS, 1989; and MDSL-USFS, 1992 are incorporated by reference into this environmental analysis.

SCOPING PROCESS

An interdisciplinary team composed of DEQ engineers, hydrologists, and reclamation specialists preliminarily defined the issues and alternatives. Public notice of receipt of the application was published in the Stillwater Sun and the Billings Gazette. Individual scoping letters were sent to the entire public mailing list, soliciting comments. In response, 11 letters were received. These responses were used to refine the issues and alternatives. On October 16, 1995, a Draft EIS was released to the public and comments on the draft were solicited. A public hearing was held in Absarokee, Montana, on November 27, 1995, to gather additional comments and concerns. All issues identified through the public scoping process are addressed and responses to comments are provided.

ISSUES IDENTIFIED AND ELIMINATED

Concerns expressed about a new tailings impoundment and an increase in employment were issues identified during the scoping process and are referred to in the 2000 TPD EIS (MDSL-USFS, 1992) as Foreseeable Activities. These issues will not be readdressed here. The ore body has a linear extent of approximately 27 miles and SMC continues to commit to incremental development consistent with state law. SMC has not proposed a new impoundment or any change in either employment or production rates. If and when SMC applies for future amendments to the permit, the effects of the specific proposals such as additional tailings impoundments would be evaluated. Site alternatives described in (MDSL-USFS, 1985) are still foreseeable. Specific impacts described in that EIS remain unchanged until SMC submits a detailed site proposal. As long as employment remains unchanged, social and economic effects described in MDSL-USFS, 1992, would not change as a result of continued mining.

A secondary issue which evolved as a result of the public hearing and comment was traffic. Concerns focused on alternative methods of separating mine traffic from public use. However, alternative methods of traffic control do not achieve purpose and need, as outlined on page 1. In addition to separation of traffic as production increases, SMC wishes to delineate ore reserves and mine under the valley and the river and to increase operational efficiency. Therefore alternative methods of traffic control have not been evaluated. See Chapter II for discussions of alternatives evaluated but dropped from further discussion.

SIGNIFICANT ISSUES

Issues identified during the scoping process that have been determined to be significant revolve around water quantity and water quality with crown pillar stability a parallel issue. Specifically, the issues are:

a. Crown pillar stability. Concerns focus on potential for disruptions of river flow should the crown pillar be unstable.

b. Water quality of the Stillwater River and the Stillwater valley aquifer. Concerns focus on the potential for increased nitrate loading.

c. Water quantities of the Stillwater River and its aquifer. Concerns focus on changes in flow in the river as well as changes in groundwater levels.

AGENCY ROLES AND RESPONSIBILITIES

The Montana Department of Environmental Quality is the lead agency for this EIS. However, several federal and state regulatory agencies are involved in the review of this EIS.

DEPARTMENT OF ENVIRONMENTAL QUALITY

Mining and Reclamation Statutes

The Director of the Department of Environmental Quality must decide whether to approve the project as applied for, approve alternative plans, approve subject to modification through stipulations, or deny the permit as required by the Montana Metal Mine Reclamation Act (MMRA)(Title 82, Chapter 4, Part 3, MCA).

The MMRA applies to all state, federal and private lands. The purpose of the act is to provide that the usefulness, productivity, and scenic values of all lands and surface waters involved in mining and exploration receive the greatest reasonable degree of protection and are reclaimed to beneficial use. The act and its rules (ARM 26.4.101 et seq.) set forth the steps to be taken in the issuance of an operating permit for and the reclamation of the applicant's proposed mine expansion.

The Director may deny a permit when it can be demonstrated that air and water statutes cannot be complied with or the reclamation plan as proposed is not feasible (82-4-351, MCA) or on the basis of other significantly unmitigatable impacts. A permit must, with certain exceptions, also be denied if a person, or any firm or business association of which that person was a principal or controlling member has had a bond forfeited (82-4-360, MCA) or may be denied for failure to reclaim an operation (82-4-341(G), MCA). SMC has not forfeited any bonds under the MMRA and has not failed in its reclamation obligations.

Reclamation bonding is also determined by DEQ under MMRA. Reclamation bonds are determined by computing costs to the State of reclaiming a site should the operator default. After an application has been approved and mitigation measures are identified, the bond is calculated based on the approved and permitted specifications. The bond would include long-term maintenance of water treatment facilities such as percolation ponds and diversion ditches, demolition of buildings and other facilities, earth movement and soil replacement, seedbed preparation and revegetation. Once bond is submitted by the applicant, the permit would be issued.

Montana Environmental Policy Act

DEQ's rules (ARM 26.2.601 et seq.) implementing MEPA (Title 75, Chapter 1, MCA) also require preparation of an environmental analysis. The Department has determined that an Environmental Impact Statement (EIS) is appropriate for this project. This EIS has several purposes:

(1). It serves to ensure that the agency uses the natural and social sciences and the environmental design arts in planning and decision-making;

(2). It assists in the evaluation of reasonable alternatives and the development of conditions, stipulations or modifications to be made part of a proposed action;

(3). It ensures the fullest appropriate opportunity for public review and comment on proposed actions, including alternatives and planned mitigation; and

(4). It examines and documents the effects of a proposed action on the quality of the human environment, and provides the basis for public review and comment.

EIS's completed on previous SMC proposals include the "Environmental Impact Statement - Stillwater Project," MDSL-USFS, 1985, and the "Environmental Impact Statement - Stillwater Mine Expansion 2000 TPD," MDSL-USFS, 1992. The 1992 EIS is still available from DEQ for those who did not get it, or wish to get another copy.

Water Quality Statutes

The DEQ is also responsible for administering several state statutes including the Public Water Supply Act (Title 75, Chapter 6 MCA), Sanitation and Subdivisions Act (Title 76, Chapter 4 MCA) and the Water Quality Act (Title 75, Chapter 5 MCA). The DEQ also administers several sections of the federal Clean Water Act pursuant to an agreement between the State of Montana and the Environmental Protection Agency (EPA). The State of Montana, through the DEQ, has been delegated authority for administration of the Nonpoint Source Pollution Program (319), National Pollution Discharge Elimination System (NPDES), and Water Quality Standards (CWA section 307).

The Water Quality Act (WQA) provides a regulatory framework for protecting, maintaining and improving the quality of water for beneficial uses. Pursuant to the WQA, the DEQ has developed water quality classifications and standards, and a permit system to control discharges into state water. Mining operations must comply with Montana surface and groundwater regulations and standards. SMC currently holds a Montana Pollution Discharge Elimination System (MPDES) permit (MT-0024716) for discharge of excess adit water into the Stillwater River.

U.S. FOREST SERVICE

The Forest Service has authority for regulating all activities and uses of national forest system lands. The Forest Service is not a decision maker in this amendment because no disturbance is proposed for forest system lands.

The 1872 General Mining Law, as amended, grants all US citizens the right to locate and develop a mining claim on national forest system lands open to mineral entry. At the same time, the Organic Administration Act of 1897 authorizes the Secretary of Agriculture to regulate occupancy and use of the national forest resources. The regulations (36 CFR 228) pertain to all national forest users who operate under the mining laws. The Forest Service retains the right to manage and dispose of surface resources on unpatented mining claims to the extent that this does not unreasonably interfere with mining activity.

The U.S. Forest Service management policy for mining activity originates from the 1872 General Mining Law, as amended, the Mining and Mineral Policy Act of 1970, the National Materials and Minerals Policy, the Research and Development Act of 1980, and a number of executive orders. It is

National Forest Service policy to encourage the exploration, development, and production of mineral resources on all lands open to mineral entry.

CHAPTER II SUMMARY OF PROPOSALS AND ALTERNATIVES

This chapter summarizes the proposed action submitted by SMC and the alternatives to the proposed action, including the no-action alternative. Alternatives have been developed and refined in order to resolve important issues. Based on interdisciplinary meetings and the public scoping process, the issues were further defined. The following sections and chapters identify how the alternatives were developed, present descriptions of each alternative and its environmental consequences and any mitigation measures required.

COMPANY PROPOSED ALTERNATIVE

INTRODUCTION

Stillwater Mining Company proposes to connect the East and West mining areas with a haulage drift driven on the 4400 level, developed in part under the Stillwater River. SMC may also, upon approval of the plan, mine the ore body at and below the 4400 level if and when mineralization is defined.

SMC plans to implement this proposed Amendment in two distinct phases. Phase I would include completion of the 4400 haulage level and the diamond drilling necessary to define the mineralization. Phase II would involve implementation of the mining plan below the surface crown pillar.

Mining procedures would follow established and permitted methods as outlined in Section 3.0 of Amendment 008 (SMC, 1990) and described in the 2000 TPD EIS (MDSL-USFS, 1992). No change in employment, mining rate or permitted tailings impoundment capacity would occur under this proposal.

PROJECT OVERVIEW

The deposit SMC is mining consists of a single, relatively narrow, steeply dipping vein (reef). The quality of the ore in the vein varies both laterally and vertically. Extensive lateral development is necessary to provide working places (stopes) for mine production (Figure 3).

Access to the ore is through surface adits named according to the entry elevation and location on the east or west side of the river. Development to date has been predominately from adits driven from the Stillwater River Valley at and above the 5,000 feet elevation, and east and west along the reef. This has allowed mining above these levels. Currently development extends about 12,000 feet east and 14,000 feet west from the zero reference point near the 5150 West Portal.

The principal reasons for constructing the 4400 haulage level are to:

- access the primary crusher before milling,
- distribute workers and materials more efficiently,
- access additional reserves, and

2000 East Cross Section (View Looking East)

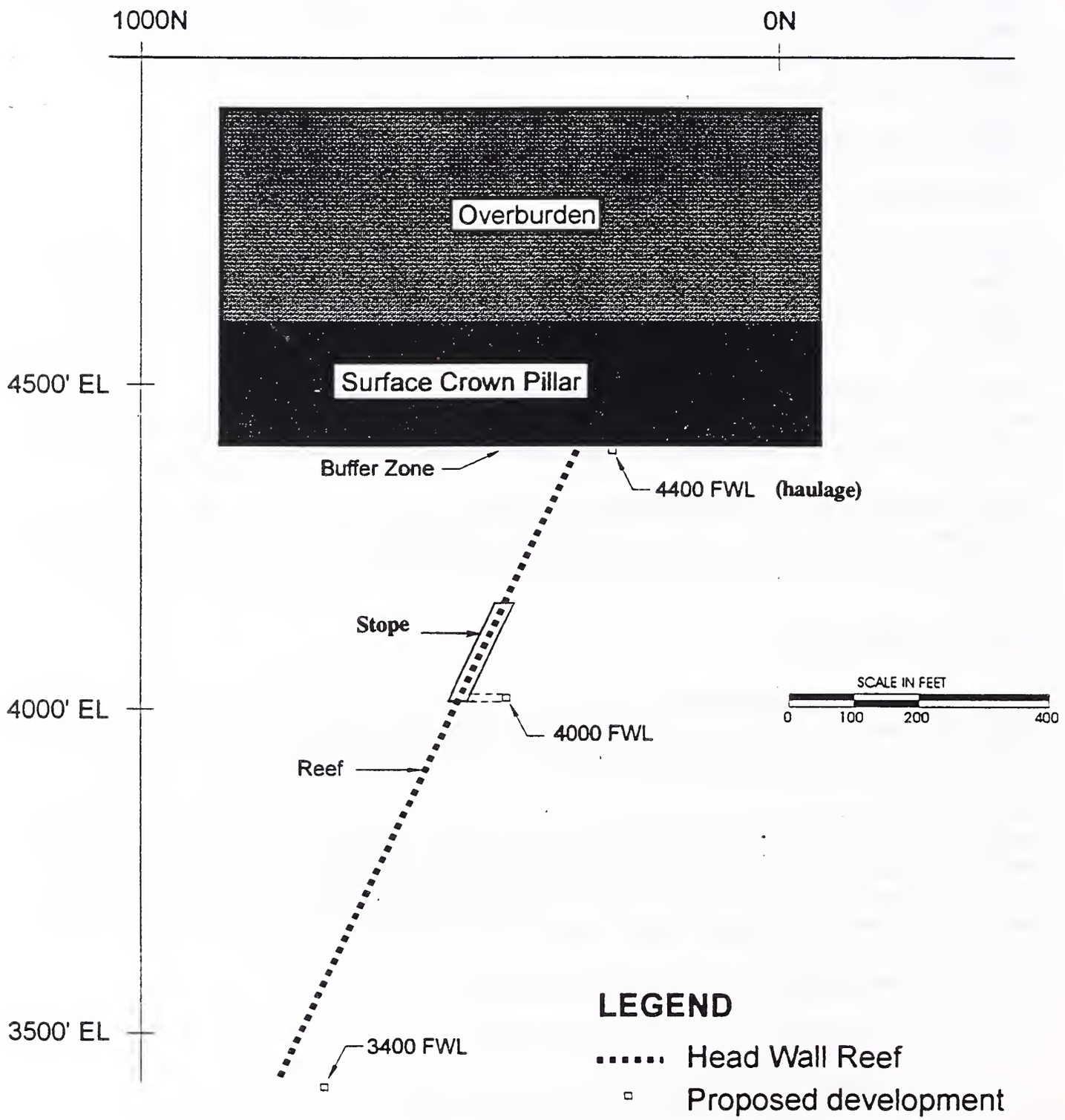


FIGURE 3

- reduce ore and waste handling costs.

In accomplishing these goals the program would:

- simplify the surface ore handling system,
- establish the underground infrastructure necessary for future mining,
- reduce transportation distances for personnel, ore, and waste rock, and
- reduce environmental impacts associated with surface transport.

Under Amendment 008, a development program to provide sufficient stopes for the mine to supply an average of 2,000 tons of ore per day to the concentrator is being implemented. As part of this program, development is being extended below the existing workings.

The shaft sinking program commenced in October 1994. The shaft, primary crushing, and hoisting facilities are to be completed in 1996. Improved efficiencies in the handling of ore and waste rock would occur after completion of the shaft system. Ore and waste would be transferred via muck raises to selected levels for haulage by rail to dumps and passes feeding the primary crusher located at the shaft complex. After hoisting, ore would be transferred to a surface storage bin or stockpile and fed to the mill.

The 4400 level has been proposed to transfer waste and ore from the east side of the mine with the installation of a track haulage system. The haulageway would connect to the westside shaft, crusher, and hoisting facilities. Waste and ore would be transferred via internal passes to the underground crusher for hoisting to the surface.

It is expected that the 4400 haulage level could be completed in approximately 6 to 8 months after approval. Mine development and production within this block would take place over many years and would be largely dependent on the grade and vertical extent of the ore body.

No additional personnel would be required aside from the 525 approved under the SMC 2000 TPD Plan of Operations (SMC, 1990) and the associated Hard Rock Impact Plan.

DEVELOPMENT AND MINING PLAN

Haulage Development

Levels developed from the shaft would be driven using rail or trackless equipment. These levels would also be used to access the ore. Beneath the Stillwater Valley the proposed 4400 haulage level would be the uppermost haulage level. The general layout of the main haulage levels is shown in Figure 4, while Figure 5 gives a typical cross-section through a haulage level.

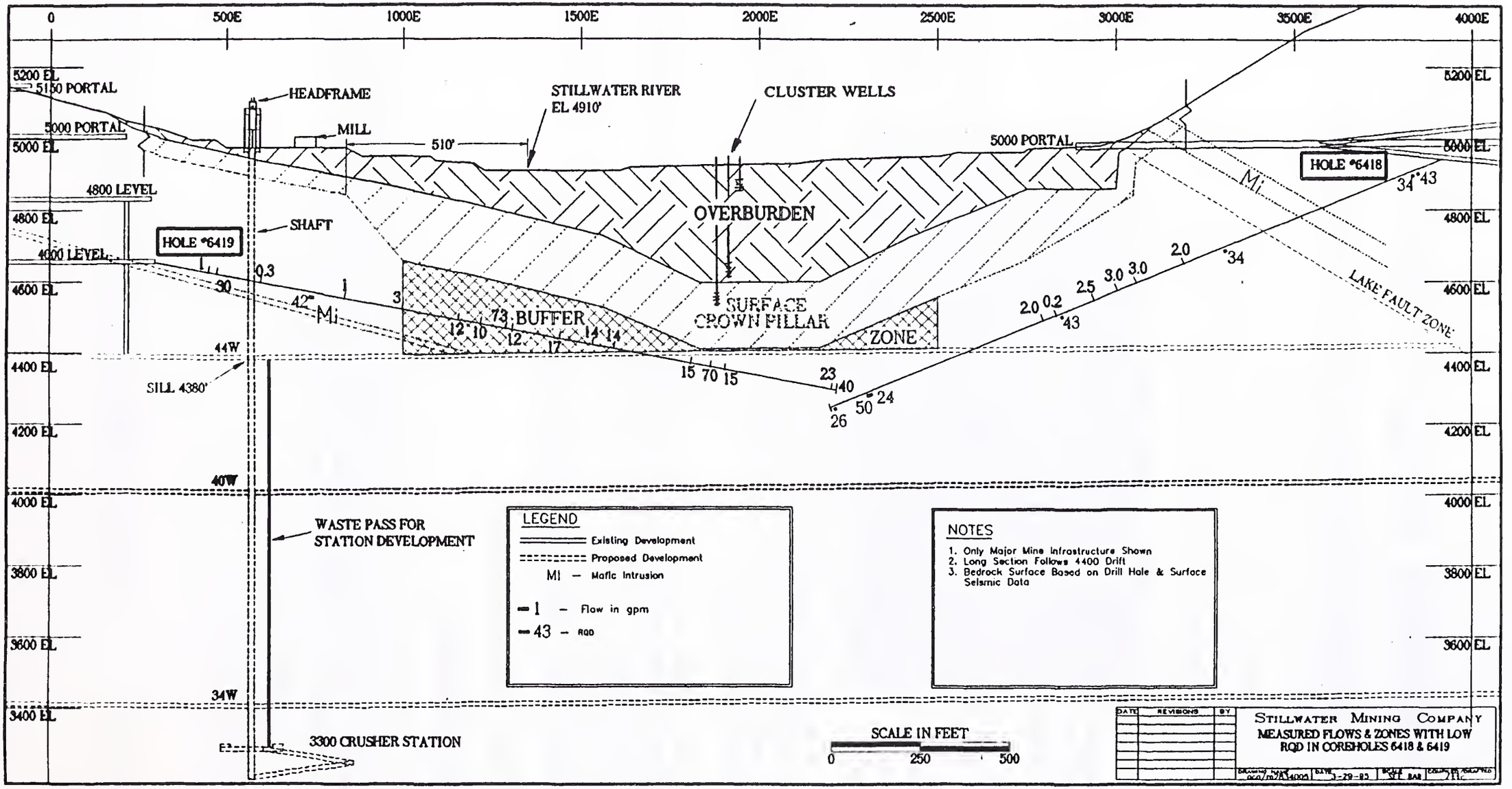
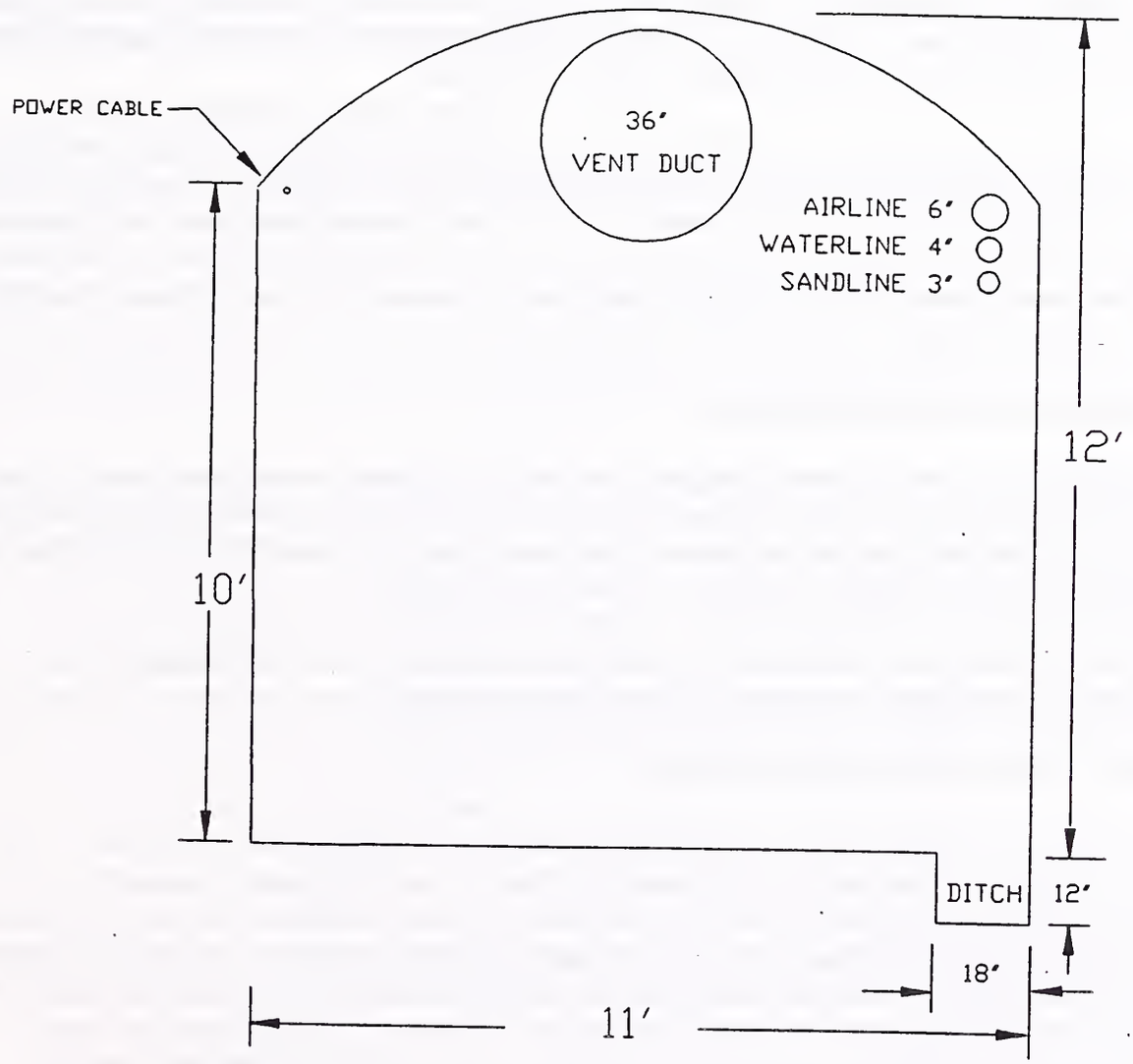

0
500E
1000E
1500E
2000E
2500E
3000E
3500E
4000E
5200 EL
5150 PORTAL
5000 PORTAL
5000 EL
4800 LEVEL
4800 EL
4600 EL
4400 EL
4200 EL
4000 EL
3800 EL
3600 EL
3400 EL
HEADFRAME
MILL
510'
STILLWATER RIVER
EL 4910'
CLUSTER WELLS
OVERBURDEN
SURFACE
CROWN PILLAR
ZONE
BUFFER
HOLE #6419
SHAFT
HOLE #6418
LAKE FAULT ZONE
Mi
44W
40W
34W
SILL 4380'
WASTE PASS FOR
STATION DEVELOPMENT
3300 CRUSHER STATION
LEGEND
Existing Development
Proposed Development
MI — Mafic Intrusion
1 — Flow in gpm
43 — RQD
NOTES
1. Only Major Mine Infrastructure Shown
2. Long Section Follows 4400 Drift
3. Bedrock Surface Based on Drill Hole & Surface Seismic Data
SCALE IN FEET
0
250
500
DATE
REVISIONS
BY
STILLWATER MINING COMPANY
MEASURED FLOWS & ZONES WITH LOW
RQD IN COREHOLES 6418 & 6419

FIGURE 4



NOTE: LOOKIN EAST

FIGURE 5

STILLWATER MINING CO. TRACKLESS HAULAGE LAYOUT	
4400 FWL	DATE: 03/10/95

As levels are established from the production shaft, raises would be developed to allow transfer of ore and waste to selected levels for rail haulage to the shaft area. All material would be handled in this way except for waste above the 5000 East level which would continue to be truck-hauled on the surface and incorporated into the east side visibility berm.

Mining Methods

Stillwater Mining Company intends to continue to make improvements to mine safety and efficiency. As new technology becomes available and experience is obtained with various mining methods, the safest and most cost-effective mining method would be employed.

Mined out areas would continue to be backfilled with mine waste rock and/or mill tails. Backfilling of mined out areas reduces surface storage impacts for mill tails and waste rock. In addition, backfill provides wall support and is thus a key element in SMC's ground control program. SMC is required to maintain a 20 to 50-foot surface crown pillar in all areas of the mine (SMC, 1984). Additionally, this amendment maintains a 200-foot surface crown pillar in the area of the mine beneath the valley floor.

Production and Waste Handling

Ore produced from the east and west mining areas would be transported underground to the crusher station located near the shaft. Waste produced on or below the 5000 East and West levels would be transported underground to the crusher station. Waste developed above the 5000 East and West level would be delivered to the surface for transport to the crusher station.

Production rates for ore and waste would be unchanged from Amendment 008. In addition, no increased surface disturbance is proposed as part of this Amendment.

Surface Crown Pillar and Buffer Zone

SMC has set aside an underground area designated as surface crown pillar and a buffer zone. The surface crown pillar or crown pillar, is a 200-foot thick zone of overlying rock between the haulageway and the alluvial aquifer. SMC has designed the pillar, as shown in Figure 4, to include a designated buffer area of additional thickness underneath the Stillwater River to further reduce the possibility of any impact. During the construction of the 4400 haulage level, this buffer zone would be maintained and excluded from the Phase II mining plan. However, in the future, SMC may request that this zone be added to the mining plan. This request would be based upon operating experience in this area and definition drilling to substantiate ore reserves, to establish expected stability factors, and to demonstrate the absence of significant water inflows.

MONITORING

Existing monitoring activities required under previous approvals would be supplemented by the five monitoring programs described below.

Aquifer Monitoring

SMC has installed a well cluster designed to monitor vertical groundwater gradients in the Stillwater Valley aquifer and underlying bedrock (Figure 4). A discharge of alluvial groundwater to the haulage would result in changes in the vertical gradients of the alluvial aquifer. The cluster is comprised of three wells completed at different depths in the alluvial aquifer and the underlying bedrock. Well screens are 10 to 15 feet in length. Two wells are completed in alluvium at depths of 38 and 261 feet below ground surface and one well is completed in bedrock at 350 feet below ground surface. The bedrock/alluvium interface is at a depth of 300 feet.

Underground Inflow Monitoring

The excavation of the 4400 haulage level would be treated as a special drifting situation. The following procedures would be used.

Daily water conditions at the face would be recorded and the ditch flow rate measured and compared to the expected flow rate. This would entail installing V-notch weirs at strategic locations. The plot of flow would provide an indication of increasing/decreasing rate change with time. Ditch flow rates would be monitored on a weekly basis during the mining stage.

Along the 4400 haulage level within the buffer zone, probe holes would be advanced in front of the mining face. These holes would be at least 80 feet long and overlap the previous probe hole by a minimum of 20 feet. These holes would be drilled in such a manner to allow the shutting in of any water flow or the injection of grout. The probe holes would be drilled from the advancing face or from a drill station parallel to the direction of advance. Monitoring of the V-notch weirs and probe holes would be conducted on a weekly basis and the results reported to the agencies on a quarterly basis during the construction and development phase of the project. The agencies would be notified of flows which are in excess of 100 gallons per minute (gpm) if they persist for an extended period (7 to 10 days). In such instances, SMC would inform the agencies of the location and corrective measures taken in dealing with such flows.

In summary, excess underground water would be pumped to the surface and land applied through the pivot irrigation system or infiltrated in the percolation ponds. This water would sampled on a daily basis to assure that no more than 100 lbs per day of nitrates are released through the disposal systems. The analyses would be submitted to and reviewed by the agencies on a quarterly basis.

Visual Monitoring

Underground conditions in the portion of the haulage under the alluvium would be systematically monitored based on a number of visual observations. This monitoring would be the responsibility of the section foreman. The following information would be recorded in addition to standard mine procedures:

- the occurrence of any drilling problems or blasthole closure, and the position, depth and probable cause,
- the amount of effort required to stabilize the face after blast,

- type and density of support installed, and

- the condition of the support along the length of the haulage. Where support shows signs of undue loading, senior mine staff would be informed immediately.

This review would be carried out weekly.

The geology of the advanced face would be mapped and the following information would be recorded:

- rock type,

- number of joint sets,

- presence or absence of any faulting,

- fracture frequency and condition, and

- groundwater inflow.

This information would be used to rate the rock at the face according to rock quality using standard rock mass classification techniques. A record of geology and rock quality would be maintained for review by senior mine staff and agency specialists.

Ground Movement Monitoring

Ground movement would be monitored using Ground Movement Monitors (GMM) and convergence measurements. Convergence measurements involve recording the relative displacement between studs installed in the back and walls using an accurate tape measure or convergence rod.

Convergence stations would be installed every 300 feet within the buffer zone area of the 4400 haulage level. Convergence measurements would be carried out once a week during active mining. If over a period of 4 weeks no movements are detected, the measurement interval may be increased after review by senior mine staff and consultation with the agencies.

Monitors may be installed in the back where poor quality rocks are encountered. The location for the monitors would be established by senior mine staff after inspection of ground conditions. Movement would be monitored until it is established that no further significant movement is occurring.

Data would be presented in tabular and graphical format to facilitate in interpretation of results, and would be submitted to the agencies on a quarterly basis during the 4400 haulage development.

Surface Subsidence Monitoring

Survey monuments would be located along the strike of the underground workings crossing the Stillwater Valley. These monuments would be monitored and checked periodically for changes due to subsidence. During construction of the haulage level and during mining, a program of surface subsidence monitoring would be carried out underground. This would allow unusual or excessive

movements to be noted, providing a warning prior to any potential significant surface disturbance.

GROUTING STRATEGY

Decisions on whether to grout or not would be based on a number of site factors including:

- the amount of uncontrolled water expected to flow into the haulage. This value is obtained from monitoring the quantity of water flowing from the probe holes, and pro-rating for the haulage excavation; and
- the consequences of developing through the anticipated inflow (volume of water, discharge limits etc.).

The action taken would be based on the criteria shown in Table 1.

Table 1. -- Action Criteria

Water Flow Category	Flow Rate	Action
1	< Ditch capacity (20 gpm)	None
2	> Ditch capacity (20 - 50 gpm)	Deepen ditch Increase sump capacity Increase pump capacity
3	>> Ditch capacity (Point inflow > 50 gpm)	Stop and grout
4	>> Ditch capacity (Area inflow > 150 gpm)	Stop and cover grout, retreat and cover grout
5	Direct connection to large water source (e.g. Surface aquifer)	Bulkhead and re-excavate

The grouting strategy is based on the management of any water inflow to meet stated criteria. Grouting can be carried out either ahead of the advancing face of the 4400 haulage (cover grouting) or at any time after the haulage has progressed beyond the area of inflow. Which approach is adopted would depend upon the volume of inflow at that particular location, and the amount of water already being sent to mine sumps.

BULKHEADS

Bulkheads would be installed only if high inflows are encountered that cannot be effectively controlled by grouting. Detailed construction drawings would be prepared before the 4400 haulage level advances underneath the buffer zone. As the haulage is extended potential bulkhead locations would be selected (based on ground conditions, etc.). All necessary materials for bulkhead construction would be maintained at the mine.

Two types of bulkheads may be required:

- temporary bulkheads to buy time in case unexpected high flows are encountered, and
- permanent bulkheads, which prevent further access to the region beyond the bulkhead.

The most conservative approach is to design a permanent bulkhead for the full hydrostatic head. The bulkhead would be located in competent ground which is not excessively fractured or broken.

NO ACTION ALTERNATIVE

The no action alternative would include maintaining the current surface haulage methods. East-side ore would be trucked across the road to the west side, dumped through an ore pass to the bottom of the shaft for crushing, then transported back to the surface ore stockpile. As production increases to 2000 TPD, increased truck traffic and surface disturbance would result.

On average 100 to 120 vehicle trips per day result from mining activities. In the next 18 to 24 months vehicle trips will more than double as production increases from the east side. Additionally, heavy equipment traffic may more than triple as the tailings impoundment nears final construction and waste rock from the west side is used in the construction of the east side waste rock and visibility berm.

PROPOSED PLAN WITH MODIFICATION

As a result of public comment on the draft EIS, the Department proposes to add the following conditions to SMC's permit. See Chapter II Selected Alternative.

The Department would expressly prohibit future mineral recovery from the 200-foot crown pillar, although SMC has not proposed mineral recovery. In addition, based on prior concerns about No Name Creek and current concerns with the Stillwater River, the Department would require SMC to adopt the same crown pillar design, monitoring, and mitigation programs for all ore recovery which occurs under any area overlain by or crossed by surface waters.

ALTERNATIVES EVALUATED BUT DROPPED FROM FURTHER CONSIDERATION

Alternative means of reducing potential mine and recreational traffic conflicts, as production increases, were suggested in comments on the draft EIS, as noted in Chapter I. Specific alternatives included a bridge or a conveyor crossing the river and the highway (County Road 419). However these alternatives do not fulfill SMC's purposes and needs which include exploration, mining and increased efficiency.

In order to consider a bridge or conveyor alternative as a mitigation for an impact, significant impacts from the proposed action must be identified. Analyses, documented in Chapter IV, do not identify any significant impacts to hydrology or geology from the proposed action.

In conclusion, a bridge or conveyor would not fulfill purpose and need, or mitigate significant impacts. Therefore, the effects of a bridge or conveyor on geology, hydrology, traffic, or mine efficiencies have not been evaluated further in this EIS.

Mining elsewhere was suggested as another alternative during public comment. However, this alternative fails to address the purpose of SMC's proposal (i.e. mine under the river and recover ore using the existing mine infrastructure). Mining elsewhere also fails to meet the criteria that alternatives be reasonably feasible. In order to mine elsewhere SMC would likely have to capitalize a whole new infrastructure: mill, tailings impoundments, etc., to operate concurrently. The environmental impacts of this type of disturbance outweigh both the short- and long-term effects identified during the analyses of SMC's proposal. Such impacts would likely include additional changes in land use, additional changes in water quality, effects on wildlife, the local economy, and other effects typical of large mining operations. Therefore, this alternative is not evaluated in this EIS.

SELECTED ALTERNATIVE

The Department has selected the proposed plan with agency modifications for implementation. Analysis shows there would be no changes in water quality or quantity as a result of SMC's proposal to tunnel and mine under the river. In addition, the analysis shows that the crown pillar and backfilling have been designed to provide adequate support of the overlying valley, further preventing impacts to the Stillwater River. The permit conditions assure that the plans developed for protecting the Stillwater River apply to other major underground stream crossings for the long-term throughout the portion of the reef regulated under operating permit no. 00118.

CHAPTER III AFFECTED ENVIRONMENT

The following section summarizes the baseline conditions for affected resources. Discussion is limited to only those resources which potentially could be impacted by the proposed action. Other information from other resource areas needed to discuss impacts will be discussed where needed in the document. A full discussion of all resources is available in MDSL-USFS, 1985 and MDSL-USFS, 1992 as well as in baseline studies submitted by SMC. Additional data is presented in monitoring reports submitted by SMC and are on file with the agencies.

GEOLOGY

General Geology

The ore body is contained in a tabular (reef) zone within a suite of ultrabasic intrusive rocks. The ore zone extends generally east-west and dips between 60 and 90 degrees. Mining widths vary from 4 feet to greater than 30 feet ("ballrooms"). The zone is influenced by faulting and shear zones associated with the ore. The continuity of the ore zone varies considerably along the strike and dip.

The reef consists of a number of rock types of varying strengths. The ore lenses vary considerably with regard to their location within the reef. Position is especially important with regard to wall rock behavior. In some areas the ore has been highly sheared, and is particularly weak and likely subject to degradation when exposed. In other areas the ore rock is highly competent.

The main hangingwall and footwall rocks are norites. These are generally strong, moderately jointed rocks. A more detailed description of the geology is found in Section 2.3 of the Plan of Operations (SMC, 1990).

4400 Level Geology

The 4400 haulage level would be driven south of, and essentially parallel to the reef complex. This drift would be located within generally competent footwall rock approximately 100 feet south of the north hangingwall contact of the reef.

Only two regional-scale faults were observed in the investigation core holes. The Lake Fault zone, an associated diabase dike, and the probable South Prairie Fault zone were intersected by hole No. 6418 (Fig 4). Evidence of the Stillwater Valley Fault was not observed. Intersections between the reef complex and the investigation core holes occurred along the same trend as the complex on the west side of the river. These intersections showed no displacement indicative of a strong cross fault in the Stillwater Valley.

Rock Fabric

Generally the footwall rocks are competent and have a blocky appearance. No ground control problems have occurred in the footwall rocks of either the east or west mining areas that could not be handled by conventional support techniques.

Three main fracture sets have been observed:

A. northwest strike, north dip

B. east-west strike, sub-vertical dip

C. north (+/-20) strike, sub-vertical dip

Fracture sets A and B are associated with the bedding, are typically tight and conduct little or no water. Some of these features could flow at very low rates as long as they are connected to a source of recharge.

Fracture set C is typically open and a good conductor of water. The volume of water inflow from these features is limited primarily by their connection to a source of recharge. They are typically connected only to a limited source of water. When intersected, type C fractures typically flow at a high rate for a short period of time, after which they either dry up completely or continue to flow at a much reduced rate.

Rock Mass Quality

Designs of underground openings are based on a number of well-established empirical and semi-empirical rules. These rules enable estimates to be made of the rock mass strength, expected mining conditions, and support requirements on the basis of a detailed description of the rock mass.

The rock quality from bore holes drilled parallel to the haulage was evaluated using Barton's "Q" classification (Golder, 1992) and is shown in Table 2. The locations of the bore holes are shown in Figure 4.

TABLE 2
ROCK QUALITY

Drill Hole Section	Rock Quality Rating (Q)
Hole 6418 Footwall Rock (0-~700 ft)	Fair
Hole 6418 Hangingwall Rock (~700 - 1,0964 ft)	Poor to Fair
Hole 6419 Footwall Rock (0-1,950 ft)	Fair to Good

~ indicates depths are approximate

Though exceptions to the above categories exist, they are generally localized, short (10 to 20 ft) intervals of lower than typical rock quality. The core logs show that these intervals are mainly associated with minor fault zones.

Rock Strength and In-situ Stress

Intact rock strength was estimated using data from compressive strength tests conducted during the initial mine permitting. Results indicate that the majority of rock in the core holes could be classified as medium strong to very strong, having an average unconfined compressive strength of 15,000 pounds per square inch (psi). Estimates of the in situ stress conditions are less than 1,000 psi. Hence, the inherent strength of the host rock is well in excess of the stresses expected at the proposed 4400 haulage level.

Seismicity

The project site is in a region of low to moderate seismic activity, on the border between Seismic Zones 2 and 3 (USACE, 1970). Previous investigations have used a peak seismic ground acceleration of 0.18g, based on regional faulting (IECO, 1986). Woodward-Clyde Consultants (WCC) reviewed the previous seismic investigations and available seismic data for the region. They completed a site-specific analysis based on current seismic data and procedures which indicate that the previously developed seismic design parameters are conservative for this site (WCC, 1994). The analysis uses standard methodology and conservative assumptions approved by agency specialists. Therefore, following DEQ's review, DEQ concurs with WCC's conclusions.

HYDROLOGY

Surface Water

Surface water features near the Stillwater Mine are dominated by the Stillwater River which flows north through the mine site. Several small tributaries flow into the Stillwater River in the mine project area and are considered sub-alpine streams. These streams are Verdigris Creek, Nye Creek, and Mountain View Creek. Most other drainages within the southeastern portion of the Beartooth Mountains also flow into the Stillwater River.

Flows in the river usually peak during June or July from snow melt and increased spring precipitation. Roughly three-fourths of the annual runoff occurs in May, June, and July. Stream flows in the Stillwater River have been measured since 1979 by the USGS at a stream gauging station located at the bridge above Nye Creek near the Stillwater Valley Ranch percolation ponds and by SMC as part of their Water Resources Monitoring Program. Annual mean flow in the Stillwater River is 367 cubic feet per second (cfs) (164,000 gpm). The highest monthly mean flow 1,758 cfs (790,000 gpm) occurs in June and the lowest monthly mean flow 50.7 cfs (22,700 gpm) occurs in March. The 7-day, 10-year low flow for the Stillwater River at the USGS gauging station is estimated to be 31.1 cfs (14,000 gpm). The maximum peak flow record was 6,400 cfs (2,870,000 gpm); the lowest recorded flow was 16 cfs (7,200 gpm), less than 1 percent of the maximum flow.

The upper Stillwater basin has a rough topography (maximum relief is 6,400 ft) and highly variable average annual precipitation (20 to 40 inches per year), which accounts for the wide range in river flows and the high spring runoff.

Groundwater

The groundwater flow system as well as groundwater/surface water interactions in the Stillwater Valley aquifer have been studied and are reasonably well understood in the vicinity of the mine site. A conceptual groundwater flow model has been developed to aid in evaluating the effects of the proposed project.

The alluvium in the Stillwater River Valley is over 300 feet thick in places and is permeable (10^{-1} to 10^{-2} centimeters per second (cm/s). The groundwater level in the valley is close to the level of the Stillwater River and fluctuates from 3 to 5 feet annually following the yearly runoff cycle. Hydrogeologic and hydrochemical investigations suggest that there is a hydraulic connection between the river and the groundwater, and that a significant amount of flow is occurring through the alluvium adjacent to and beneath the river bed (Gurrieri, 1993).

Observations of intact rock in the mine workings suggest that primary permeability is negligible. Inflow of groundwater to the mine workings is considered to be controlled by fractures (faults, joints, etc.). The volume of groundwater inflow to the mine workings through these fractures depends on:

- the permeability of the fractures, and
- how well the fractures are connected to a source of recharge.

Most of the fractures observed in the mine are tight and do not conduct significant groundwater. Some open features have been observed, however, that could carry significant flows. The east side of the mine workings is noticeably wetter than the west side. This can be partly attributed to the thicker overburden cover above the eastern workings, which has a greater storage capacity for water. In addition, the fractures on the east side appear to be slightly more vertical. This may play a role by providing better connections between the workings and the overlying surficial soils.

Water level measurements collected in December 1995 from the recently installed cluster wells show an overall downward component to groundwater flow throughout the alluvial and bedrock aquifers above the proposed location of the haulage.

Groundwater Quality

The groundwater quality within the project area has been thoroughly documented in annual water quality reports to the agencies and in previous Environmental Impact Statements (EIS) such as SMC 2000 TPD. These reports document the generally good quality of the groundwater. Acid rock drainage is not a problem at the Stillwater Mine. Acid/Base accounting tests are performed on waste rock and tailings annually to determine their acid generating potential. All tests conclude that these materials do not produce acid.

Underground Inflow

The SMC 2000 TPD EIS anticipated water inflows to the underground workings to be in the range of 1,900 gpm. SMC's Nondegradation Report for the third quarter of 1995 shows average adit water discharge at 940 gpm.

Two core holes have been drilled along the proposed 4400 haulage. The final flow rate reported from the west core hole was 46 gpm. This rate represents the total contribution of all flowing features along 1,951 feet of core hole. In general, there are very few correlations between flowing intervals and changes in lithology or structural features.

Interception of No Name Creek

In April of 1987, Stillwater Mining Company (SMC) received an exploration permit to investigate ore reserves on the east side of the Stillwater River. During May 1988, SMC reported to the agencies that increased adit water inflows had been encountered in the exploration adit and that it was likely that the increase was attributable to the interception of ground water flows feeding No Name Creek. Additional monitoring requested by the agencies and an investigation conducted by the Hard Rock Bureau and DNRC's Water Rights Bureau confirmed that No Name Creek had indeed been intercepted by SMC's exploration activities.

Monitoring which had been initiated at the beginning of exploration activities and had been required by the agencies in approving the exploration project, indicated that the flows from No Name Creek averaged approximately 161 gpm during the 7 months preceding the interception. Subsequent water rights investigations estimated that in a period of normal precipitation, the mean annual flow in No Name Creek was closer to 450 gpm. Currently, east side adit flows, as measured through the east side clarifier, are averaging approximately 650 gpm. SMC estimates that of the 650 gpm exiting the east side adit, approximately 150 gpm can be attributed to the interception of No Name Creek. The upper reaches of No Name Creek still flow; however, the flow has been reduced to a level where the entire flow now infiltrates into the ground before reaching the valley floor.

SMC currently holds the beneficial use rights on No Name Creek and east side adit waters. These waters are currently put to use in the milling and mining process as make-up water. Additionally, these waters are disposed of through SMC's Land Application and Disposal system (LAD) during the summer months and are percolated into the ground water aquifer during the winter months.

CHAPTER IV ENVIRONMENTAL CONSEQUENCES

EFFECTS OF COMPANY PROPOSED ALTERNATIVE

This chapter summarizes the effects of various alternatives on impacted resources. The agency's interdisciplinary review of the proposed project and public concerns have identified limited impacts to the following resource areas: geology and hydrology. Because no changes in surface facilities and mining rates would occur, there would be no additional effects to resources such as wildlife, fisheries, revegetation, or other surface resources. Similarly, no additional social economics effects would result from SMC's proposal. Thus the analyses in SMC 2000 TPD EIS (MDSL-USFS 1992 and in the Integrated Resource Analysis (USFS 1991) remain valid for all other areas.

Summary of Effects from SMC 2000 TPD EIS

The effects of previously permitted activities are highlighted in Table 5.0-1 of the SMC 2000 TPD EIS (MDSL-USFS, 1992) on pages 181 and 182. This document is still available from the DEQ and the USFS. However, a brief summary is provided below.

The agencies permitted Alternatives 3c and 5 (MDSL, 1992a) with the restriction that SMC meet water quality standards set by the Board of Health and Environmental Sciences. The agencies' analysis of these alternatives documented that the tailings impoundment capacity would not change, but impoundment life would be reduced from the year 2013 to approximately 2003. SMC implemented additional nitrate controls to ensure discharge levels would continue to comply with nondegradation standards and SMC developed additional sites for land application of nitrate laden waters.

Reclamation plans were modified to enhance reclamation and reduce long-term visual effects from the tailings impoundments. In addition plant community diversity was increased which enhances Big Horn sheep habitat.

SMC remains in compliance with air quality standards and a visual screening berm is being constructed on the east side of the River. Traffic was projected to peak at 262 cars per day during non-construction periods. However, the road is being upgraded pursuant to SMC's approved Hard Rock Impact Plan.

GEOLOGY

Surface Crown Pillar Stability

The stability of crown pillars is influenced by a number of factors, including:

- size of the pillar,
- groundwater,
- geology and rock quality,
- stope geometry, and
- stress regime.

Adequately sizing the surface crown pillar to ensure it remains stable both during its operating life and after closure is very important. Due to the complex inter-relationship between these parameters, no general analytical solutions for design of surface crown pillars are available. Empirical methods of design are used based on case histories of other mines.

From a rock mechanics perspective, crown pillar design must satisfy two general requirements. The first is that a stable crown pillar geometry must be provided. The second is that stability of the underlying excavations must be maintained, since stope instability could change the crown pillar geometry.

Stable crown pillar geometry can be determined by examining typical failure mechanisms for crown pillars. These mechanisms are often structurally controlled by joints or faults. No faults were identified during the investigation which would cause overall instability of the surface crown pillar.

The planned width of the 4400 haulage level is 12 feet while the average thickness of the surface crown pillar is 200 feet. This results in a thickness to span ratio of 16 for the pillar. It is a generally accepted engineering practice that when this ratio exceeds 10 there is sufficient rock mass and confinement to result in an "infinitely" strong pillar.

As an additional check, an empirical relationship for design of crown pillars (Carter, 1990) has been applied. Parameters describing pillar geometry and rock weight are combined to determine a factor called the "Scaled Critical Crown Pillar Span." This factor is plotted against the estimated rock mass quality on a stability analysis chart, derived from a large number of case histories.

The analysis indicates that the proposed crown pillar dimensions are adequate even at a span of 35 feet. The long-term stability of the pillar is not considered to be an issue, particularly because SMC proposes to backfill the 4400 haulage level where it is adjacent to the base of the surface crown pillar at closure. In addition, all stopes would be backfilled upon completion of mining.

Groundwater

A large number of mines operate immediately below bodies of water (lakes, rivers etc.), many in rocks of similar quality to those at Stillwater with substantially smaller surface crown pillars than is currently proposed. Thus, there is substantial precedent for SMC developing the 4400 haulage level beneath the Stillwater River. Table 3 provides information on a number of these mines with the 4400 level haulage at SMC shown for comparison purposes. The hydrology discussion provides additional information on groundwater.

Table 3
Selected Mines Operating Beneath Bodies of Water

Mine	Location	Thickness (ft)/span (ft)
Chisel	Manitoba	0.94
Eagle Point	Saskatchewan	3.3
Kiena	Ontario	4.4

Spruce Point	Manitoba	2.4
Namew Lake	Manitoba	0.6
Westarm	Manitoba	12.0
Lakeshore	Ontario	2.1
Tech Hughs	Ontario	3.3
American Tunnel (Sunnyside Mine)	Colorado	~ 1.3
Stillwater Mining Co.	Montana	16.0

~ indicates approximate values

Table 3 would be quite extensive if all the mines that actively mine under bodies of water were listed. In addition, there are many civil projects that have excavated openings immediately below bodies of water. The Channel Tunnel is probably the most famous but almost every major city in the US built around a river has a road or rail tunnel under the river.

Stope Geometry and Rock Quality

Though the surface crown pillars have been sized to maintain control during active mining, long-term stability can only be assured if the stopes immediately beneath the surface pillars are backfilled. Otherwise, raveling of the roof may occur over time.

Large amounts of surface disturbance, easily noticeable to the naked eye, can be caused by shallow mining. This type of subsidence is difficult to predict, and is initiated when the roof of a mined void fails and the material in the roof falls into the void. Because the material is disturbed when it reaches the floor, it takes up more volume than the in-place material. As a result, there are three possibilities when roof failure occurs:

1. The roof caves until a stable configuration is achieved, either because a more stable geometry is achieved (for example an arch where a flat roof had existed before), or because a stronger material is encountered in the roof strata; or

2. The roof may cave until the surface is reached, in which case disturbance of the surface would result; or

3. The material which has fallen from the roof expands enough to fill the original void plus the new void created by the fall itself, in which case the roof would be supported by the collapsed roof rock, and no further caving would occur.

Of these possibilities, the only one that is readily quantified is the last. Development of surface disturbance cannot occur if the depth to the mined void being considered is greater than a critical depth, which is that depth at which the failing material swells to entirely fill the available void. This

depth is a function of the swell factor and the excavated height. Thus, to consider surface disturbance potential, one must consider both roof failure and the nature of the overburden material.

Roof span failure may occur at any time in any mine. It is most likely to occur in weak rock and in areas with wide spans. In general, it occurs soon after (or even during) mining. The 4400 haulage level would be driven through generally strong, competent rock of fair to good quality. Zones of poorer quality rock are anticipated but they are expected to be limited in extent.

Given rock strengths in the mine area, short-term instability is unlikely. Even in mines which have been stable for many years, however, there remains a finite probability of span collapse. This probability cannot be predicted with any degree of accuracy or confidence.

As swell factors in most rocks are about 20 to 30 percent, the highest risk of failure appearing at surface is when the depth of cover is less than about three to five times the excavated height. At ten times the excavated height, only in very exceptional circumstances should a void migrate through to the surface. For the 4400 haulage, the depth of cover (200 feet) is 16 times the excavated height (12 feet).

The 4400 haulage level would be fully supported and maintained during its operational life. Any poor ground would thus be quickly rehabilitated and secured.

Placing backfill in mine stopes would effectively limit any slough that occurs, assuring the long-term stability of the surface crown pillar. By reducing the amount of void beneath the bottom of the surface crown pillar, the thickness of crown pillar which can fail before becoming self supporting, due to the swell of the fallen material, is greatly reduced.

Backfilling is an integral part of the mining method at Stillwater. Therefore all stopes would be filled as part of the mining process. This would greatly reduce the void height beneath the surface crown pillar and further ensure its long-term stability.

Upon cessation of mining SMC would backfill the portions of the haulage directly under the Stillwater Valley, thus effectively mitigating against any local roof collapse breaching the surface crown pillar. The sections of the haulage that have in excess of 200 feet of overlying rock do not pose any risk to the environment and would not be backfilled.

Stress Regime

Given the estimated stress regime, the stability of the back and walls of the haulage level would be controlled primarily by structure (see discussion in Chapter III). Stress induced fracturing is not considered an issue. The majority of the haulage is stable and, assuming good blasting practices, would only require spot bolting. However, SMC proposes to systematically support the haulage. This support would be intensified, as appropriate, in areas of poor ground.

Seismic Stability

Woodward-Clyde Consultants (WCC) reviewed the previous seismic investigations and available seismic data for the region. They completed a site-specific analysis based on current seismic data and procedures. Their analysis indicates that the previously developed seismic design parameters are

conservative for this site (WCC, 1994). WCC's analysis uses conservative assumptions and standard methodologies, approved by agency specialists. DEQ reviewed the analysis and concurs with the conclusion.

If an earthquake occurred during the operational life of the tunnel, it is likely that the tunnel would be unaffected or minimally affected. Documentation to this effect occurred at Tangshan, China, in 1976 (Wallace, 1995, letter to DEQ). In the event of an earthquake, collapse of the underground workings would not cause any surface disturbance and would have a negligible (if any) effect on water resources.

Geotechnical Monitoring

Underground conditions in the portion of the haulage under the alluvium would be systematically monitored based on a number of visual observations. This monitoring would be the responsibility of the section foreman. The following information would be recorded in addition to standard mine procedures: the occurrence of any stuck steel or blasthole closure; the position, depth and probable cause, the amount of scaling effort, type and density of support installed, and the condition of the support along the length of the haulage. Where support shows signs of undue loading, senior mine staff would be informed immediately.

The geology of the advanced face would be mapped and the information would be used to rate the quality of rock at the face using standard rock mass classification techniques. A record of geology and rock quality would be maintained for review by senior mine staff and agency specialists.

Ground movement would be monitored using Ground Movement Monitors (GMM) and convergence measurements. Convergence measurements involve recording the relative displacement between studs installed in the back and walls using an accurate tape measure or convergence rod.

Surface subsidence would be monitored by installing survey monuments along the strike of the underground workings crossing the Stillwater valley. These monuments would be monitored and checked periodically for changes due to subsidence. During construction of the haulage level and during mining, a program of surface subsidence monitoring would be carried out underground. The monument plan proposal is adequate to allow unusual or excessive movements to be noted, providing a warning prior to any potential significant surface disturbance.

HYDROLOGY

Effects on River Flow

The predicted rate of inflow to the haulage way (200 gpm or higher short-term inflows) should not have an impact on flow in the Stillwater River or groundwater levels in the valley for either the short or long term. In the valley above the proposed haulage, the Stillwater River is a losing stream. That is, water in the stream discharges to the groundwater resulting in a decrease in stream flow. Approximately 3,200 feet downstream from the surface trace of the haulage, the stream begins to gain. This means that groundwater discharges to the stream causing flow in the stream to increase. A lowering of the water table above the haulage near the river would cause an increase in the amount of water that the stream loses in the affected reach. To illustrate the effects of water table fluctuations on stream flow, a hypothetical example follows:

Assuming that approximately 800 feet of stream length above the haulage would be affected by leakage of water from the alluvial aquifer to the haulage tunnel and potential stopes, each foot of water table decline would cause the river to lose an additional 250 to 350 gpm of water to the aquifer. A reduction in flow of 350 gpm amounts to 2.5% of the 7-day, 10-year low flow of the river. This reduction in flow would not be manifested very far downstream because the excess water intercepted in the haulage would be pumped to the surface and land applied or percolated back into the aquifer immediately downstream from the affected reach. Recharge of the aquifer through land application and percolation would cause an increase in water table elevation and a consequent increase in groundwater discharge to the gaining reach of river downstream from the USGS gaging station.

In summary, if the haulage causes a lowering of the overlying water table, the volume of water leaving the stream and entering the aquifer in the losing reach would be roughly balanced by the volume of water entering the stream in the gaining reach, with no net effect to stream flows downstream of the mine property. At closure the mine workings under the valley would be completely backfilled causing the water table in the alluvium to return to the pre-mine level.

Because of the low permeability of the 200-foot thick crown pillar above the haulage and stopes, and the monitoring and contingency measures described in Chapter II, the probability of lowering the water table and reducing flows in the river is very low.

Comparison to No Name Creek Interception

Effects to the Stillwater River from the proposal, similar to the interception of No Name Creek, are unlikely due to differing hydrogeologic settings. The east-side adit was driven relatively close to No Name Creek in an area of highly fractured rocks. The entire flow of No Name Creek was derived from springs that discharged out of the hillside above the 5000 level adit. Driving of the adit intercepted some permeable fracture zones causing the water table to drop in the overlying rock. Since springs discharge at a point where the water table intersects the ground surface, it follows that a drop in the water table would cause those springs to stop flowing. Presently, there are springs that do still feed No Name Creek but they are much diminished in flow.

In contrast, the proposed haulage will be driven 200 feet below the bedrock surface and 500 feet below the Stillwater River. The Stillwater River is not fed by springs in the vicinity of the haulage but is instead fed by runoff from a 200 square mile drainage basin in the Beartooth Mountains. Therefore, a drop in the water table under the Stillwater River would not appreciably affect river flow and would certainly not dry the river up.

Similarly, the river cannot simply disappear into the haulage or stopes. Even if a large open fault or fracture is intercepted which extends upward to the base of the alluvium, the rate of drainage of water from the alluvial aquifer is limited by the permeability of the alluvium itself. For example, assume that a fracture 6 inches wide and 50 feet long is intercepted by the haulage or a stope, and that it extends all the way up to the bottom of the alluvial aquifer. Given that the permeability of the alluvium is 10^{-1} cm/s, the rate of flow from the alluvium into the fracture would be about 37 gpm. This rate of loss from the aquifer would not affect the elevation of the water table and consequently river flow would not be reduced.

Groundwater Inflow to the Haulage

The chief concern for the proposed haulage level is whether or not a highly conductive fault or fracture zone exists that is well connected to the alluvium in the Stillwater Valley. Lithologic and flow information from the investigation core holes do not indicate the existence of any such features. The flows observed from these core holes were all associated with discrete features of local extent.

Inflows to the proposed 4400 haulage level are expected to be primarily through fracture sets A and B described in Chapter III. These sets may have some connection to the alluvium, but their low permeability would limit the inflow volumes. Inflows from these features are expected to be on the same scale as the flows observed in the east-side mine workings.

Given that flow in the bedrock is fracture controlled, it is not possible to accurately predict the peak inflows that would be encountered by the 4400 haulage level. The peak flows encountered by the investigation core holes dissipated in less than a day indicating that the flowing features were not well connected to a source of recharge. Therefore the peak flows are not considered representative of the long-term inflows to the 4400 haulage level. The steady state flow measured from the entire west side core hole provides a more reliable measure of the long-term inflows.

The expected rate of inflow to the 4400 haulage level was estimated using standard methods. This analysis suggests that steady state inflows to a 4,000-foot long section of the 4400 haulage level would be approximately 200 gpm. This estimate does not consider the effects of a grouting program.

The investigation core holes did not encounter any types of flowing fractures which were not amenable to grouting. Thus the potential for impact would be further reduced given the proposed management program which includes a grouting program. Utilizing the control measures permitted in Section 8 of the Plan of Operations (Stillwater Mining Co., 1990) it is highly unlikely that operational flows would exceed those predicted in the SMC 2000 TPD EIS (MDSL-USFS, 1992).

Effects on Water Quality

Groundwater quality is not expected to change for either the short or long term following the implementation of this proposal. Mine production rates and the associated nutrient loading from mining activities would not be increased by way of this amendment and would not exceed the levels analyzed in the SMC 2000 TPD EIS. (See chapter 4.2 of MDSL-USFS, 1992) Excess underground water would be pumped to the surface and land applied through the pivot irrigation system or infiltrated in the percolation ponds. This water is sampled on a daily basis to assure that no more than 100 lbs per day of nitrates are released through the disposal systems. The analyses are submitted to and reviewed by the agencies on a quarterly basis to demonstrate compliance with SMC's permitted nitrogen discharge limits. SMC's Water Resources Monitoring Program includes ambient monitoring of the Stillwater River downstream from the adit water disposal facilities.

Hydrologic Monitoring

SMC has installed a well cluster designed to monitor vertical groundwater flow gradients in the aquifer. A discharge of alluvial groundwater to the haulage or a stope would result in changes in the vertical gradients of the alluvial aquifer. Vertical gradients are evaluated by measuring the differences in water levels in closely spaced wells that are screened at different depths in the aquifer.

If these water levels change with respect to one another, then the vertical gradients in the aquifer have changed. If changes in vertical gradients in the aquifer are detected by monitoring and can be tied to inflows in the mine, then SMC will be required to reduce the rate of inflows by grouting, placing bulkheads, or other operational measures. Monitoring of the wells would continue until the agency determines that it is no longer necessary. After closure, the mine would fill with water up to the level of the east and west adits where mine water would discharge. These adits are above the level of the Stillwater River therefore leakage from the river is not an issue.

Inflows to the haulage would also be monitored and reported to the agencies. Daily water conditions at the face would be recorded and the ditch flow rate measured and compared to the expected flow rate. The plot of flow would provide an indication of increasing/decreasing rate change with time. Ditch flow rates would be monitored on a weekly basis during the mining stage.

Along the 4400 haulage level within the buffer zone, probe holes would be advanced in front of the mining face. These holes would be at least 80 feet long and overlap the previous probe hole by a minimum of 20 feet. These holes would be drilled to allow the shutting in of any water flow or the injection of grout. Monitoring of the probe holes would be conducted on a weekly basis and the results reported to the agencies on a quarterly basis during the construction and development phase of the project. The agencies would be notified of flows which are in excess of 100 gpm if they persist for an extended period (7 to 10 days). In such instances, SMC would inform the agencies of the location and corrective measures taken in dealing with such flows.

Contingency Plan

If high inflows are encountered underground that cannot effectively be controlled by grouting, SMC would install bulkheads in the haulage to stop the inflow of water.

EFFECTS OF MODIFICATIONS TO THE PROPOSED PLAN

Modifications to the proposed plan would prohibit secondary recovery from crown pillars and require standardized crown pillar design, monitoring and mitigation. These conditions make it explicit that the crown pillar would remain intact for the long term. Then there would not be an increased risk to the Stillwater River at some point in the future without further environmental analyses under MEPA. The buffer zone would be excluded from the Phase II mining plan. SMC may, in the future request that this zone be added to the mine plan. This request could be based upon operating experience in this area and definition drilling to substantiate ore reserves, establish stability factors and demonstrate the absence of significant water inflows.

These conditions would also apply to other major underground stream crossings thereby reducing the risk of drying up springs or creeks elsewhere in the reef.

EFFECTS OF NO ACTION ALTERNATIVE

The no action alternative would include maintaining the current surface haulage methods. As production increases to 2000 TPD, increased truck traffic and surface disturbance would result. SMC's permitted activities, surface disturbance, and traffic issues are described in detail in the SMC 2000 TPD EIS (MDSL-USFS, 1992).

Currently impacts from surface transportation are minor. On average, approximately 100 to 120 vehicle trips or crossings per day result from mining activities on the east side of the Stillwater River. In the next 2 years vehicle trips will more than double as production increases from the east side. Additionally, heavy equipment traffic may more than triple as the tailings impoundment nears final construction and waste rock from the west side is used in the construction of the east-side waste rock and visibility berm.

If the 4400 haulage is not built, crown pillar stability would not be a concern, nor would water quality changes or river flow reductions.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Production of ore under the Stillwater River Valley would be a permanent and irreversible commitment of the resource.

CUMULATIVE IMPACTS

Geology

Cumulative effects to geology remain unchanged because mining rates would not change under this proposal. Ultimately, as previously identified, SMC may incrementally continue to recover ore from the reef as long as permitted facility capacity would allow. No changes in capacity are proposed under this plan.

Hydrology

SMC is bound by limits on water quality and water rights. No cumulative effects to water quality, quantity or use are expected to result from implementing the valley crossing in addition to previously permitted activities. No new sources of nitrates would result from implementation of the proposed plan. Thus, SMC is anticipated to remain in compliance with water quality standards. Monitoring is included in SMC's plan. Results would either verify this analysis or provide new information to direct the agency to reevaluate its analysis and either develop additional mitigations or modify operations to provide appropriate levels of environmental protection.

EVALUATION OF RESTRICTIONS ON PRIVATE PROPERTY

This assessment has been added to this EIS in order to comply with the requirements of Senate Bill 231, which was passed by the 1995 Montana Legislature and is now in effect.

Under the proposed action and selected alternative SMC would exercise its property and water rights in order to recover the minerals. The Department's proposed action would result in two permit conditions. These are:

1. a requirement prohibiting secondary recovery from the crown pillar under the Stillwater River, and

2. a requirement to apply the protective measures from SMC's proposal to the recovery of ore under any area overlain by or crossed by major surface waters.

The Department could impose lesser requirements for crown pillar design and closure, however, the conditions adopted are consistent with, and merely formalize, parameters proposed by SMC. The economic loss to SMC for leaving a 200 foot crown pillar is approximately 1 million dollars. SMC, however, concurs the proactive measures are appropriate for the Stillwater River and the Department's analysis documents that these measures appropriately protect the river. Therefore, these measures can appropriately be tied to other comparable sites along the reef where SMC may exercise its right to recover minerals. Adoption of any lesser standards increases potential risk of environmental harm such as disrupting the flow of major springs or creeks.

CHAPTER V COMMENTS ON THE DRAFT EIS AND RESPONSES

In this chapter the agency responds to substantive comments received on the draft EIS. Substantive comments are those which question analyses or procedural steps; statements such as the necessity of jobs, or of approval, disapproval, etc., are personal opinions which cannot be responded to by the agency.

The draft EIS comments in this chapter are identified as either agency or public comments. For example, a letter would be designated A1-1 for agency letter 1, comment 1, or P3-2 for public letter 3, comment 2. The agency's responses immediately follow each comment. The letters and transcript of oral testimony (designated by a T) from the November 27, 1995, public hearing have been reproduced and substantive comments identified. Where similar comments were addressed, answers were cross referenced.

One agency letter and 21 letters from the public were received. Four persons spoke at the Absarokee public hearing on November 27, 1995.

TABLE 4 - COMMENTS RECEIVED

	AGENCY LETTERS	
A1	MT Department of Fish Wildlife & Parks	Billings
	PUBLIC LETTERS	
P1	Stillwater Protective Association	Nye
P2	Robert Wallace	Portola Valley, CA
P3	Jack and Paula Shemer	Nye
P4	Ralph N. Adams	Billings
P5	Elmer Leischner	Billings
P6	James Southworth	Laurel
P7	Richard and Joanne Nauman	Nye
P8	Arnold Silverman	Missoula
P9	Jack Barker	Nye
P10	Jim Milligan	Nye
P11	Dan B. Fisher	Billings
P12	Mary Donohoe	Nye
P13	John P. Simmons	Absarokee
P14	Carl Klein	Absarokee
P15	Jeffrey Buchowiski	Bozeman
P16	Jeanne-Marie Souvigney	Greater Yellowstone Coalition
P17	Patrick McCave	Nye
P18	F.A. Baukol	Nye
P19	W. Wayne Fitkin	Billings
P20	Keith E. Martin	Nye
P21	Industrial Tool & Repair	Billings
	ORAL TESTIMONY	
T1	Jack Heyneman	Nye
T2	Jim Mulligan	Nye
T3	Noel Peel	Nye
T4	Norm Hiett	Billings

WRITTEN COMMENTS RECEIVED IN RESPONSE TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Montana Department of Fish, Wildlife and Parks
Billings, Montana

A1-1 On page 42, the DEIS states that reductions in flows due to losses to the haulage "would not be manifested very far downstream." Approximately how far downstream would you expect effects?
RESPONSE: Reductions in river flows are not expected. The purpose of the analysis described in the EIS was to illustrate the effects of a hypothetical one foot lowering of the water table. For the purposes of this analysis the effects to the river were assumed to extend about 3000 feet downstream.

A1-2 What percent of low mean flow would the projected losses represent?
RESPONSE: The 7-day, 10-year low flow of the river at the mine site is 13,958 gpm. A reduction in flow of 350 gpm amounts to 2.5 percent of this flow.

A1-3 Could an earthquake open fractures in the overburden? Has a contingency plan been developed to respond to significant river losses to the haulage?
RESPONSE: Fractures do not develop in unconsolidated sand and gravel deposits like those that make up the Stillwater River alluvial aquifer. The agency's analysis indicates a very low probability for river losses due to the proposed action. The contingency plans for excessive inflows to the haulage are described on pages 15 and 16 of the EIS and in greater detail in SMC's application.

Stillwater Protective Association
Nye, Montana

P1-1 In order for the Mine to exploit the east side of the river at depth and not have to drive a drift under the river and haul the muck up the shaft on the west side, the Mine can sink another 600 foot shaft on the east side of the river and mine the east side at depth.
RESPONSE: A shaft on the east side of the river does not achieve the purpose and need of the project (i.e. exploration and evaluation of potential mining under the river as well as transport). Therefore it is not included as an alternative.

P1-2 Is it possible that if SMC has an accident in mining the ore body under the river that the State would share responsibility with SMC for the accident? Such an accident could cost some lives. As State had granted the mine permission to tunnel and mine under the river this implies the State believed that the mining could be done safely with no risk to the miners. The implication is that the taxpayer would eventually pay for the accident.
RESPONSE: The safety of working conditions is established by regulation under the purview of the United States Mine Safety and Health Administration and the Department of Labor and Industry. These standards are already established with public review and are therefore beyond the scope of the environmental analysis. Any governmental liability occurring from hazardous working conditions would rest with these agencies.

P1-3 The reclamation of the drifts under the river would not be simple, as it would be anticipated that several levels of drifts would have to be present in order to do the type of stope mining that SMC has done in the past. How is this to be accomplished? Also, how would these drifts be handled in terms of bulkhead placement and construction in case of interception of large quantities of water?
RESPONSE: Stopes below the 4400 level, beneath the valley floor, would be backfilled during the mining process. Only the 4400 level haulage would be backfilled. Haulageways below the 4400 level would not be backfilled because they would not be expected to result in surface subsidence. Ground control and grouting procedures are expected to limit inflows to manageable levels; therefore no bulkhead construction is anticipated in haulageways below the 4400 level.

P1-4 On p. i at the bottom of the page, we have observed very little "conflict with recreational traffic" due to trucks crossing the road to Woodbine. First the recreational traffic is primarily only during the summer months. Also if this turns out to be a problem for the truck drivers, a triggered traffic light could be put at the crossing point or, as has been suggested, an over-pass could be constructed at this point. Trucks or a conveyer system could be used to transfer material across the road. This is not a valid reason for driving a tunnel under the river in our opinion.
RESPONSE: A bridge or conveyor system could cause more surface disturbance than the proposed tunnel. Additionally, these alternatives do not achieve the purpose and need of the project, one aspect of which is to access and further delineate additional ore reserves under the valley.

P1-5 The reasonably foreseeable activities must be addressed here, including the need for a new tailings impoundment. SPA has gone to court and won a requirement that the USFS must consider the cumulative effects of proposed development activities through the use of an Integrated Resource Analysis.
RESPONSE: The Forest Service is not involved in permitting the 4400 level haulage, as no federal lands will be effected by the proposed action. However, the potential impacts of other tailings impoundments are described in MDSL-USFS, 1985, and MDSL-USFS, 1992. The USFS has completed an integrated resource analysis (USFS, 1991) which also contains information.

P1-6 The construction of a tailings impoundment at the Hertzler ranch, for example, would have far reaching effects on county planning and if it is to occur in the next few years the impacts must be known now.
RESPONSE: A proposal for a new impoundment has not been submitted to the agency. If and when a proposal is submitted it will then go through its own permitting process and EIS review. This proposal does not increase or decrease the 27 miles of identified reserves. Projected impacts from a Hertzler conceptual plan were previously identified in MDSL-USFS, 1985.

P1-7 What are the impacts of surface transportation? One of the stated goals is to reduce the impacts of traffic.
RESPONSE: Traffic is described in Chapter II and in MDSL-USFS, 1992.

P1-8 The possibility of striking large quantities of water underground always is present in mining. If uncontrollable amounts of water are intercepted, what will be done with the water?

1. Pumped to the surface and then where?
2. Chemical monitoring to determine the possible contaminants in the water?
3. Treatment to get the water to an acceptable quality?
4. What is the level of quality and who checks to make sure it meets Montana water quality standards?

RESPONSE: See Chapter II. In summary, excess underground water will be pumped to the surface and land applied through the pivot irrigation system or infiltrated in the percolation ponds. This water is sampled on a daily basis to assure that no more than 100 lbs per day of nitrates are released through the disposal systems. The analyses are submitted to and reviewed by the agencies on a quarterly basis. If uncontrollable inflows are encountered the tunnel will be bulkheaded. Excess inflows would not be an issue after closure because the stopes and haulage under the valley would be backfilled.

P1-9 We realize that the last thing that the Mine wants is an underground disaster like this, but if it happens, what will the USFS, the State and the Mine do? What is done will have an effect on the ground and surface water quality, and that concerns us, and should concern the responsible agencies. We see no mention of details in the DEIS.
RESPONSE: Contingency plans have been developed for dealing with uncontrollable inflows. These include grouting and bulkhead placement. See pages 15 and 16 of the EIS.

P1-10 Concerning the "No Action Alternative," there needs to be more discussion here. We don't believe this is sufficient information to be used for analysis of increased truck traffic, surface disturbance, impoundment facilities and the like.
RESPONSE: Increased truck traffic, surface disturbance and impoundment facilities do not result from SMC's proposed action. Under both the No Action Alternative and the proposed action, disturbances and impoundment facilities would remain as described in the SMC 2000 TPD EIS. Highway crossings by haul trucks and support vehicles, however, would decrease under the proposed action by about one half. Under the No Action Alternative, road crossing would peak at about 200-250 trips per day when full production is reached.

P1-11 The interpretation of core samples should not be left up to the mine. The State must also make an analysis of the cores and logs to arrive at an independent judgement of the geological structure wherever mining is to occur.
RESPONSE: Cores were drilled and analyzed by a reputable geotechnical consulting firm. The results of the drilling program were reviewed by agency engineers who concurred with the consulting firm's interpretation.

P1-12 It has been shown that the rock strength is a factor in determining tunnel failure, but the most important part of the in-situ rock parameters that determine tunnel failure are the direction and strength of the joints and the block size related to tunnel size. The statement made here is a gross oversimplification.
RESPONSE: The Q classification system for tunnel design is used world wide as a means of describing key rock characteristics. The value obtained is then used to predict tunnel stability. Joint strength and block size are thus incorporated into the stability analysis.

P1-13 The concern about Canadian mining under bodies of water is misplaced. In 1977-78 the Sunshine mine in Colorado tried mining gold under a lake and the lake flooded the mine. So much for history. Mining under bodies of water is a chancy enterprise at best.
RESPONSE: The purpose of quoting Canadian and other mining experience was to illustrate the substantial precedent for mining and tunneling under bodies of water. Mines have flooded usually as a result of mining with too small a crown pillar or due to unknown geologic features. It is for these reasons that SMC installed exploratory drill holes and has committed to leaving in place a substantial crown pillar. The exploratory holes drilled so far did not intersect any large water bearing faults or fractures.

The Sunshine Mine is in Idaho. In the 1940's, miners purposely drilled up into an overlying river and flooded the mine to put out an underground fire. The mine in Colorado that you are probably referring to is the American Tunnel Mine, also called the Sunnyside mine located near the town of Silverton. For details of the Sunnyside Mine inundation see MSHA (1978). A summary of the incident follows:

Lake Emma, a mountain lake, above the mine broke through the roof of the 2,580 stope located on an upper level of the mine on June 4, 1978. Over 500,000 gallons of water, along with a large amount of slide rock and mud, poured through the mine. Most of the water exited through the Terry Tunnel and the lower American Tunnel, while most of the mud and slide rock remained in the mine. No one was in the mine at the time of the incident.

Lake Emma, with a surface elevation of 12,250 feet, was a glacial lake about 80 feet deep. The distance between the bottom of Lake Emma and the top of the 2,580 stope was about 80 feet. The company apparently assumed this 80 foot crown pillar to be a solid rock mass. A large portion of this overlying material was not rock but was instead mud, slide rock and remnant glacial ice. Reportedly, no exploratory drill holes had ever been drilled up into the crown pillar prior to mining. The 2,580 stope was about 30 feet wide, 200 feet long, with about 5 to 6 feet between the floor and roof. Records from mining in the area during the late 1800's and early 1900's indicate that bulkheading was necessary in some old stopes because of water problems.

This incident illustrates why measures described in the EIS for the SMC proposal, like a 200 foot crown pillar, exploratory drilling, grouting, water inflow monitoring and aquifer monitoring are necessary. It is the opinion of the agency that these measures are adequate to protect water resources in the Stillwater Valley.

P1-14 There should be an inclusion of data to back up this statement, "unlikely" means what? The failure of the rock allowing water to flow into partially filled drifts is not an acceptable occurrence. The drifts are partially filled because the fill material is a lot softer than the surrounding rock and the back of drifts and possibly the ribs will collapse when loaded by the failed crown pillar creating a path for the flow of river into the mine, creating a nasty ground water contamination problem. The localized stresses in the rock could be higher than stated and in odd directions so predictions of tunnel response to long term loading are not obvious.
RESPONSE: "Unlikely" means that there is a low probability of occurrence. Through many years of mining at SMC, it has been shown that water discharging from the mine does not contain any contaminants other than nitrates. Placing backfill in the mine stopes would limit any collapse, assuring the long-term stability of the crown pillar.

P1-15 There is a need for substantiating evidence for the statements concerning inflow and the impact on flow in the Stillwater River and groundwater levels in the valley.
RESPONSE: Widely accepted predictive methods and years of data from a broad, comprehensive monitoring system were used to assess the effects on water resources. The agency's analysis indicates that there will be no impact to water levels in the aquifer or to flows in the Stillwater River.

P1-16 If the Mine encounters waste rock that contains sulfide minerals and these rocks are deposited in the tailings dam they will become a source of acid mine drainage. This would bring a new dimension into the water flowing through the tailings dam. What is being done to monitor this possibility?
RESPONSE: Acid/Base accounting tests are performed annually on the waste rock and the tailings to determine their acid producing potential. All tests, to date, indicate that these materials do not produce acid. Additionally, 20 years of geologic exploration on the Stillwater Complex has shown no evidence of acid producing characteristics within the host rock.

P1-17 What data are available to support the claim that a similar interception as that at No Name Creek is "unlikely"? This is not an entirely different situation.
RESPONSE: At the time of the interception of No Name Creek, SMC was not grouting workings to prevent the interception of ground and surface water. The proposal calls for the grouting of inflows as a preventative measure to minimize inflows. Grouting would limit inflows during mining and after closure water in the mine would discharge from the adits that are above the level of the river. See expanded discussion in Chapter IV of the EIS.

P1-18 We request the monitoring reports for the four groundwater sites indicated here. These data should be made available in the DEIS.
RESPONSE: Monitoring wells MW-T2A, MW-11A, MW-9A, AND MW-20A were the wells originally proposed by SMC to monitor the aquifer. Subsequently the agency decided that these wells were not adequate to monitor the vertical gradients in the aquifer that would be crucial for detecting impacts from tunnel inflows. Three cluster wells were installed in November 1995 and these are the wells that will be used to monitor impacts to the aquifer. Monitoring reports are available for public review at the DEQ offices in Helena.

P1-19 When the new vertical gradient monitors are installed, as a mitigation measure it should be required that SMC present the information produced by these instruments to an independent organization for analysis. This is important for the credibility of the monitoring in general.
RESPONSE: Data generated from the cluster wells will be analyzed by agency hydrologists.

P1-20 The construction of a new tailings impoundment at the Hertzler Ranch, for example, would have far reaching effects on county planning and if it is to occur in the next few years the impacts must be known now. SPA went to court to get the requirement for the Integrated Resource Analysis in the first place and it is a principle that we are dedicated to.
RESPONSE: No plans have been submitted by SMC requesting approval for a new impoundment. If and when an application is submitted the county would have opportunities to respond. Such an application would go through its own permitting process and EIS review. Such a process is likely to take at least a year. If the proposal were to result in increased employment above the limits set in SMC's Hard Rock Impact Plan, SMC would have to renegotiate with the county.

P1-21 The construction of another vertical shaft on the east side of the river would be the most likely response to a No Action Alternative and is, in fact, more desirable from our standpoint than the proposed tunnel under the river for several reasons, providing of course that mining of ore under the river is prohibited forever.
RESPONSE: Please see response to comment P1-1.

P1-22 SPA is recommending the No Action Alternative or a second alternative which would allow the construction of a vertical shaft on the east side of the river with no mining or tunnelling allowed under the river.
RESPONSE: See response to comment P1-1.

Robert Wallace
Portola Valley, California

P2-1 The section on seismicity, p. 31, is poorly conceived and essentially meaningless. Very large uncertainties dominate all seismic analysis of this region. The USACE report dated 1970 must be considered out of date. The quoted IECO report of 1986 could not have considered several important papers published since 1986.
RESPONSE: A review of the seismic design criteria for the Stillwater Mine's tailings impoundment was undertaken in 1994 by an independent consultant. The review confirmed the use of a peak horizontal acceleration (pga) of .18g. This was based on a seismic event occurring on the Emigrant Fault. Taking into account geologic mapping data published in 1987 suggesting Quaternary Age (and younger) movement along only a portion of the fault within the last 12,000 years, as well using an empirically derived magnitude-rupture length relationship to estimate the Maximum Credible Earthquake (MCE) for the site, a revised assessment of the seismic potential of the area was conducted. This analysis confirmed the use of an MCE of 7.0 given any potential movement along the segmented Emigrant Fault. Using acceleration attenuation relationships, an earthquake of this magnitude occurring along the Emigrant Fault would generate pga's of less than the .18g which is currently used in the analysis. Furthermore, as noted in Mr. Wallace's comment number P2-4, underground workings are not as severely affected by earthquakes as are surface structures. Additionally, the stability analysis concludes that in the event of an earthquake, collapse of the underground workings would not cause any surface disturbance and would have a negligible (if any) effect on water resources.

P2-2 An almost total lack of good seismologic and earthquake fault-geology analyses characterizes this part of central Montana. Rather than kid oneself with almost meaningless statements about "0.18g.", it would be much more honest to acknowledge an extremely wide range of uncertainty. Something should be said about spectral response, duration of shaking, and probability of earthquakes within a specific time spans. All conclusions should be expressed in a probabilistic format.
RESPONSE: As part of the updated seismic design criteria review conducted in 1994, the probability of a "random" earthquake event occurring was incorporated into the analysis. This approach is currently used by the U.S. Bureau of Reclamation (USBR) in its seismic hazard analyses of dams, and is based on the principle that earthquakes are known to occur without an association with a known or mapped fault. For the western U.S., random earthquakes fall in the range of magnitude 6 to 6.5. A probabilistic epicentral distance from the mine site was estimated using earthquake recurrence parameters for the Middle Rocky Moun-

tains and an exposure period of 50,000 years. The study results included MCE's for random (with respect to location of occurrence) earthquakes and their probabilistic epicentral distances (distance from the earthquake source to the mine). Maximum Credible Earthquakes occurring at random and not in conjunction with known tectonic features are estimated to be 5.5, 6.0, and 6.5 with probabilistic epicentral distances of 10 km, 17 km, and 31 km, respectively. This data suggested that the M 5.5 event (occurring at a closer location that the Emigrant Fault) would produce higher spectral accelerations at periods longer than 0.5 sec, as well as a longer duration of ground shaking. Acceleration response spectra (5% damped) were calculated using empirical attenuation models for this event (M = 5.5) at a distance of 10 km. The effects of such an occurrence fall within the scope of those effects displayed in Chapter IV and discussed in your prior questions.

P2-3 My findings strongly suggest that the Horseman Fault, which breaks to the surface within a few miles of the mine, should be classed as an active fault, because it appears to offset late Quaternary fan gravels. Earthquake shaking energy would be released at depth along the fault as well as at the surface break itself.
RESPONSE: A recent publication of the Seismological Society of America (1987) on the seismicity and faults of this area of Montana did not identify the Horseman Fault as having evidence of recent movement. Conversely, the use of the Emigrant Fault as the source of the MCE is based on their examination of its surface expression. Although its length is estimated at 53 km, only 25 km of the fault exhibit geologic evidence of late Quaternary movement. Also, the use of random earthquake events (see response to comment P2-2) in the seismic analysis of the Stillwater Mine site in part addresses events occurring at much closer proximity than the Emigrant Fault.

P2-4 Underground workings are generally not as severely effected by earthquakes as are structures built at the surface. I am surprised that the EIS does not report this "good news." One example, during the devastating earthquake (M7.8) at Tangshan, PRC in 1976, almost no damage occurred underground in the coal mines.
RESPONSE: Appropriate text modifications have been made in Chapter IV.

P2-5 Strong earthquake ground shaking commonly opens existing fractures in mountain blocks resulting in out-draining of ground water, dropping water-table levels in the mountain block and adding significantly to the flow of streams. Such changes occurred during the 1989 Loma Prieta, California earthquake of 1989. The effects of draining the Beartooth Mountain block under strong earthquake shaking has not been evaluated or mentioned in the EIS.
RESPONSE: Draining of the Beartooth Mountain Block would possibly increase surface water flows but would likely have little effect on inflows to the underground workings.

Jack E. and Paula M. Shemer
Nye, Montana

P3-1 The report does nothing to explore possible consequences, error analysis and cumulative effects of the proposed action. We believe this is inexcusable. An environmental impact analysis should thoroughly analyze and discuss probable consequences of any proposed action.
RESPONSE: Please see chapter IV for environmental consequences of the proposed action and cumulative impacts of the proposal. The stability analysis, inflow analysis, and the water resources impacts analysis were done using conservative assumptions.

P3-2 We suspect SMC's primary motive for building the haulageway is to mine underneath the Stillwater River. Accordingly, this proposal is misleading, deceptive and mistitled.
RESPONSE: Chapter IV and subsequent chapters of the draft EIS clearly discuss mining under the river and include the words "Mine Plan" in the title.

P3-3 What if there is an undetected fault which could cause over instability of the pillar? Even though the mine is located in a region of low to moderate seismic activity, what about the possibility of any earthquake?
RESPONSE: SMC has conducted exploration drilling to determine if faults are present. None were detected. In addition, SMC would drill in advance of the tunnel face to detect unstable geologic structures.

P3-4 Mine is well known for its unstable and fragile geological structure (6 deaths and numerous serious injuries have occurred since operation recommenced). All of these facts imply a high level of uncertainty.
RESPONSE: The ground falls that have occurred have been very localized in nature. No regional or large scale stability problems have been encountered during the past 9 years of mine life.

P3-5 It is proposed that mining will occur under the Stillwater River which involves the accompanying creation of stope. What effect could this have on the strength of the pillar? The report states there are "zones of poorer quality rock" and there is "a finite probability of span collapse." Can we afford the risk of empirical trial and error engineering?
RESPONSE: If SMC chooses to mine under the valley, the mining will take place below the 200 foot crown pillar. No mining will be allowed in the crown pillar itself. The crown pillar stability analysis includes the creation of stopes. See also response to Questions P3-4 and P3-8.

P3-6 Curiously, "Table 3" was presented to show examples where mining occurred under a body of water with no appreciable adverse results. Are there counter examples where activities under a body of water resulted in disasters?
RESPONSE: Please see response to comment P1-13.

P3-7 Prior experiences of SMC are cause for alarm. Were the adverse experiences on No Name Creek a surprise or were they expected? What did engineering analysis predict? The entire flow of No Name Creek "now infiltrates into the ground before reaching the valley floor." Will No Name Creek be restored when mining operations cease?

RESPONSE: Please see response to comment P1-17. There are no plans or requirements at this time to restore flow to No Name Creek.

P3-8 The report states in the event of a void migrating to the surface or fault in the haulageway, "any poor ground would thus be quickly rehabilitated and secured." What could happen until the poor ground is secured?
RESPONSE: If poor ground was encountered, miners would pull back under supported ground and begin systematically placing support (rock bolts, timbers, steel sets, shotcrete, etc) until the ground failure was fully supported.

P3-9 Table 2 presents rock quality sample results for the overlying side of the ore body which confirms another statement "in some areas the ore has been highly sheared, particularly weak and likely subject to degradation when exposed." It only takes one poor zone to create a catastrophe.
RESPONSE: Please see response to comments P3-3 and P3-8.

P3-10 The DEIS states the chief concern for the proposed haulage level is the possible existence of a "highly conductive feature or fracture zone." Although the small sample of investigation results were negative, which could happen? Were enough core samples taken? It was noted the east side of the mine workings are noticeably wetter and that fractures appear to be slightly more vertical. What does this portend for conduction of significant water flows? Could the Stillwater River flow significantly diminish or disappear entirely?
RESPONSE: Any conductive fault or fracture zones would be detected by probe holes drilled in front of the advancing face. These zones would be grouted before the tunnel advances through them. The agency's analysis shows that the Stillwater River would not disappear or diminish in flow.

P3-11 The predicted rate of inflow to the haulageway is 200 gpm. But this is a steady state analysis, what does transient analysis predict? Steady state predictions can be highly misleading.
RESPONSE: As mining progresses, inflows will fluctuate depending on the permeability of the rock that is being mined through at the time. If large water-bearing fractures are intercepted, short-term inflows could be higher. Experience at the mine has shown that when a water-bearing fracture is intercepted the inflows diminish dramatically within a few hours to a few days. Inflow to the completed tunnel assuming that no grouting had been done is calculated to be 200 gpm.

P3-12 The report also states that the volume of water leaving the stream would be "roughly balanced" by the volume entering the steam in the downstream reach. But, the maximum recorded flow of the Stillwater River is more than 100 times the lowest measured flow. What does this imply for transient/peak flow disturbances of the Stillwater River?
RESPONSE: Induced seepage from the stream bottom is less dependent on stream flow than on the permeability of the stream bed and the elevation of the water table in the underlying aquifer. Therefore seepage from the stream does not increase or decrease appreciably with increasing or decreasing stream flow.

P3-13 It is stated that "data collected over the last nine years of mine operation should be useful in documenting significant changes in groundwater flows." What actions will be taken if significant flow changes occur? After the fact, what can and will be done?

RESPONSE: Contingency plans in the case of uncontrollable inflows have been developed and are described in Chapter II of the EIS and in SMC's proposal plan (SMC, 1995).

P3-14 The DEIS contains no discussion of error analysis and/or possible consequences of analysis error(s). In our opinion, this omission makes it impossible for anyone to objectively evaluate the effects of the proposed action(s) on the quality of the human environment. The consequence of this omission is contrary to one of the main stated purposes of the EIS.
RESPONSE: The possibility of analysis error was taken into account by using conservative assumptions in the crown pillar stability analysis, inflow analysis, and the water resources impact analysis. Thus the analysis provides reasonable assurance that impacts beyond those described would not occur.

P3-15 The report repeatedly notes that during and at conclusion of mining activities, mined-out areas would be backfilled; water treatment facilities, percolation ponds, diversion ditches, etc. would be maintained; buildings would be demolished and removed; and soil movement, replacement and revegetation would occur. Presumably reclamation bonds would be and are established to guarantee that this will occur. What assures us these bonds are adequately funded to reclaim the site if the operator defaults? What assures us that these funds are constantly added to and increased to adjust for inflationary increases of reclamation costs? Are these reserves safely held totally separate from SMC access or incurred liability of SMC?
RESPONSE: Bonding requirements for all mines in Montana are set out in section 82-4-338 of the Metal Mine Reclamation Act. Bonding calculations are based on costs to the Department. As such, administrative costs and mobilization costs are built into the calculation. Bonds are reviewed every five years to assure that the bond reflects present reclamation costs which therefore takes into account inflation and other increases. An operator submits its bond to the Department and monies are inaccessible until the permittee demonstrates it is eligible for bond release under 82-4-338, MCA.

P3-16 Given that SMC intends to mine the area for many years what protects our future? Supposedly, if the haulage way is approved the SMC would at cessation backfill "portions of the haulage." Why wouldn't the entire haulageway be filled?
RESPONSE: The portion of the haulage directly below the crown pillar will be backfilled. The sections of the haulage that have greater than 200 feet of crown pillar do not pose any risk to the environment and therefore need not be backfilled.

P3-17 We believe the risks of adverse and irreversible environmental impact far outweigh any arguments for the proposal. As we wrote previously, the probability of a catastrophe and/or permanent damage due to enactment of this mining proposal is finite, be it 1 in 100; 1 in 1,000, 1 in 10,000; 1 in 100,000, etc. Why should we subject the environment and the population to such costly and/or irrecoverable risks?
RESPONSE: Based on the agency's analysis, the risk of environmental damage from the proposed action is minimal. Risk was evaluated qualitatively. See response to P3-14. The agency has chosen the proposed plan with modifications as its preferred alternative because it believes that, at the low level of risk of adverse environmental impact and the low severity of that potential impact, the benefits of the plan with modifications outweigh the detriments.

P3-18 Why not adopt the "No Action Alternative?" Surface haulage might be more expensive and less convenient for SMC, and SMC wouldn't be able to exploit the ore lying under the

Stillwater River, but with "No Action," the environment would be safer? If ground traffic becomes a problem, SMC should be required to build a bridge over Highway 419 or construct a covered conveyer belt across the river and highway.
RESPONSE: Please see response to comments P1-4 and P3-7, and additional text in Chapters I and II. A bridge or conveyor does not fulfill the purpose and need for the project and does not reasonably mitigate predicted impacts.

Ralph N. Adams, Jr.
Billings, Montana

P4-1 I worked as a core sampler at the Benbow, Mouat, and Gish sites, for the Bureau of Mines in 1941 - 1942, so I'm quite familiar with the makeup of that highly faulted areas. I believe any disturbance of the ground under the river bed could cause irreparable damage to the entire Stillwater River Valley.
RESPONSE: Please see response to comments P3-7 and P3-8.

P4-2 I don't think that the Stillwater Mining Co. has enough assets or could afford to pay the premiums to get adequate insurance to even begin to repair any damage should anything go wrong.
RESPONSE: Please see response to comments P3-3, P3-7, P3-8, and P3-15.

P4-3 I am also concerned as to the seriousness and qualifications of the Inspectors. I refer to the recent incident on the Boulder River.
RESPONSE: Inspection and enforcement procedures are established in the Metal Mine Reclamation Act. The incident that you refer to (crews working under authority of Sweet Grass County Commissioners drove a front end loader into Boulder River) was not related to mining and did not involve Hard Rock Bureau inspectors. The MMRA and other statutes have provisions for public recourse if the public believes inspections were done improperly.

Elmer Leischner
Billings, Montana

P5-1 It will more than likely disturb the river in its construction, plus disturbing fish habitat, plus disturbing spawning areas.
RESPONSE: The agency's analysis concludes that the proposed action will have no effect on surface water flows. Consequently fish habitat and spawning areas would not be affected.

James Southworth
Laurel, Montana

P6-1 Alternatives to a tunnel, like a bridge a new shaft or no action alternative, should be given more consideration in a draft environmental statement.
RESPONSE: Please see response to comment P1-4 and additional text in Chapters I and II. A bridge does not fulfill purpose and need for the proposal.

Richard and Joanne Nauman
Nye, Montana

P7-1 Since there are other alternatives available to connect the east and west mining areas (such as truck hauling, or an overpass for the truck traffic, or some type of structure over the road for a properly designed conveyor belt that could be used to safely carry the ore, etc.,) the tunnel under the river should not even be considered.
RESPONSE: Please see response to comments P1-4 and P6-1.

P7-2 Has the mine considered the long-term costs and consequences should the river "drop through" into the mine? As stated in the DEIS, No Name Creek has already been intercepted and its natural route destroyed by SMCs exploration. If the SMC monitors for this type of thing, why did it occur and why couldn't it happen as such underneath the river? It was mentioned at the public meeting that a lake has disappeared into the Sunshine Mine in Colorado so we know it can and does happen.
RESPONSE: Please see responses to comments P1-13 and P1-17.

P7-3 References to the types of rock in the area (page 40, paragraph 3) state the rock "is generally strong, competent rock of fair to good quality. Zones of poorer quality are anticipated..." Nothing here sounds very assuring!! Paragraph 4 states "there remains a finite probability of span collapse. This probability cannot be predicted with any degree of accuracy or confidence."
RESPONSE: Although there may be a finite probability of span collapse, the rock is generally strong with localized areas of poor ground. The analysis has shown that even if left unsupported, the upward progression of any collapse would not penetrate through the crown pillar. See also response to P1-13.

P7-4 Page 7, number 2B states, "concerns focus on the potential for increased nitrate loading." So the mine is admitting "No Guarantees", therefore the questions, should we "gamble" with this tunnel?
RESPONSE: The total load of nitrates that SMC is allowed to discharge would not increase under this proposal over what was permitted in the 2000 TPD EIS.

P7-5 SMC not only proposes to tunnel beneath the river and its flood plain but they also want to mine beneath the river also--neither of these should be permitted. As we see it, the draft reads if Phase I is approved, SMC can proceed with Phase II which is the mining at and below the 4400 level. Does this mean they can proceed without the approval of the Montana Department of Environmental Quality?
RESPONSE: Mining under the valley is part of what is being analyzed in this EIS. If a permit is granted for this proposal, then SMC would be permitted to mine under the valley without further approval from DEQ.

Arnold Silverman
Missoula, Montana

P8-1 Given the importance of the surface crown pillar, DEQ should restrict both exploration and mining within the pillar block for the life of the mine.
RESPONSE: SMC has not proposed to do any mining in the 200-foot thick crown pillar. However, the agency would stipulate in the permit that no mining shall take place in the crown pillar.

P8-2 Evaluation of groundwater inflow into the 4400 haulage level depends upon the results of a dynamic groundwater model for the Stillwater River valley geology. Such a model has not been presented and, therefore, cannot be analyzed for accuracy and completeness in the current application. The Hard Rock Bureau conclusions may be correct, but evidence or substantiation has not been presented.
RESPONSE: The groundwater flow system in the Stillwater Valley alluvial aquifer at the mine site has been studied for a long time and is well understood. Approximately 9 years of data are on file, and open to public review, which were used to characterize the groundwater flow system. The conceptual groundwater flow model used to analyze the effects of driving the tunnel was substantiated through the use of a computer three-dimensional groundwater flow model. Both approaches to the problem yielded similar results - that is, tunneling and mining under the valley will have no appreciable effect on water table elevations or river flow.

P8-3 Ground movement monitor (GMM) data and convergence measurements need to be collected for a period of at least 16 weeks, not four weeks, before the measurement period is increased or measurement ceases completely. Rock creep and threshold slip forces develop slowly and may not show movement events in such a short period. Strain gauge data should be collected over the life of the mine.
RESPONSE: The GMM will be located in what is considered to be brittle rock. Thus deformation is expected to be negligible and generally lower than the accuracy of the instrument. Therefore the 4-week period should be satisfactory.

Jack Barker
Nye, Montana

P9-1 There are other options like over the river or use the one they have, there is conveyors.
RESPONSE: Please see response to comment P1-6.

Jim Milligan
Nye, Montana

P10-1 Additionally, I would like to comment that permit approval of only the haulageway and denial of phase two to further mine under the river, would, in my opinion, only result in a request for one more amendment (#10?) to be added to those listed on page 5 of the DEIS.
RESPONSE: The agency is not considering a prohibition of Phase II (mining under the river) because the analysis performed documents that the mining would have no effect on water resources in the valley.

Dan B. Fisher
Billings, Montana

P11-1 I have noticed that the amount of water in the river seems to be down from what it normally is with the exception of the high water, I am sure they are using plenty of water from the river although they indicate they are not.
RESPONSE: Based on the stream flow records at the USGS gaging station, and on flow data collected by SMC, there is no evidence that SMC is having a negative impact on river flows. SMC has water rights on the Stillwater River, however SMC does not use river water for

anything other than fire suppression. Adit discharge water is the primary source of process water.

P11-2 In regard to the tunnel, overall I feel that there will be long-lasting effects with the possibility of the river eventually collapsing into the tunnel causing serious problems 20-30 years from now.
RESPONSE: Please see response to comment P1-15.

P11-3 The fact that they fill the tunnels back up with the waste from the activity at the mine, is a concern. In my way of thinking the material they put in these tunnels is full of nitrates as they do a lot of blasting.
RESPONSE: SMC has been backfilling stopes for many years. Water quality data collected on mine discharges shows elevated nitrates. This water is disposed of through land application and in percolation ponds. SMC is allowed to discharge up to 100 lbs of nitrates per day. This limit will not change under the new proposal. SMC has never had a direct discharge of adit water to the Stillwater River and has maintained compliance with its MPDES discharge permit for the Stillwater River. Once mining ceases, land application and percolation of water would continue until nitrate levels return to background levels.

P11-4 I have a good well with sweet fresh water and I am concerned with this activity that might block the same water that goes to my property.
RESPONSE: Please see response to comment P1-15.

Mary Donohoe
Nye, Montana

P12-1 If traffic is such a problem on the F.S. road a light, or over or underpass would take care of that problem and leave the River undisturbed.
RESPONSE: Please see response to comment P1-4. An over or underpass would not achieve purpose and need as described in Chapter 1. No impacts are anticipated which would warrant use of a bridge or conveyor.

P12-2 As a citizen of Montana, "unlikely" and "unexpected" several places in the EIS, certainly do not set my concern about the safety of the Stillwater River to rest.
RESPONSE: No activity is without some level of risk. The design of SMC's plan minimizes risk as much as possible. Contingency plans for unexpected occurrences are described in the EIS and would mitigate any significant effect. The analysis provides reasonable assurance that unanticipated impacts would not occur.

John P. Simmons
Absarokee, Montana

P13-1 I believe a tunnel under the Stillwater River would be better than a conveyor or a bridge above the River. There is the chance that a spill could occur in the River from above ground activity, and also the dust when the wind blows, could spread contaminates in the air.
RESPONSE: Comment noted.

Carl Klein
Absarokee, Montana

P14-1 SMC can build a bridge to cross the river like everyone else does. I am unconvinced that a tunnel is the expedient method of crossing the river. Bridges work just fine.
RESPONSE: Please see response to comment P6-1. A bridge would not meet the purpose and need and no impacts are anticipated which would warrant use of a bridge or conveyor.

P14-2 If a tunnel under the river would create more jobs, perhaps, but any jobs created from such a tunnel would be temporary at best.
RESPONSE: No additional personnel are required for this proposal.

P14-3 SMC has already impacted the river far too much.
RESPONSE: SMC has been monitoring the flow and water quality of the Stillwater River since 1988 and has submitted monitoring reports annually. In addition, agency personnel periodically conduct monitoring. To date, no mine-related impacts to the river have been detected.

Jeffrey Buchowiski
Bozeman, Montana

P15-1 A present day assessment should include at least three groundwater monitoring wells in each discreet aquifer encountered in the overburden. Borings to characterize the subsurface should be advanced using the Rotasonic or equivalent drilling technology and be capable of retrieval of continuous samples. Any drilling method which does not retrieve continuous samples may miss zones in the subsurface containing fines and clays which can act as a confining layer.
RESPONSE: In November 1995, three cluster wells were drilled using a mud rotary drill rig. A consulting hydrogeologist logged the stratigraphy of the alluvium by examining the cuttings coming up out of the hole. No fine materials indicating the presence of a confining unit were in the cuttings. Thus, the Department is confident that no confining layers are present.

P15-2 Borings completed with continuous sampling will allow for wells to be screened in individual aquifers. The proposed well cluster should be designed to monitor each individual aquifer encountered based on the results of continuing sampling. Double casing of wells should be considered to ensure a complete seal between aquifers.
RESPONSE: The wells were screened at different elevations in the alluvium and bedrock, one at the top of the alluvium, one at the bottom of the alluvium, and one 50 feet into the underlying bedrock. Because no evidence of confining units were present in the cuttings, double casings were not needed.

P15-3 Groundwater monitoring should be conducted using the most modern technology. A system such as Realflow could monitor key groundwater wells and relay their status continually to a mine office. Correlations between aquifers and adit interceptions would be easier to track. Pressure transducers could also be installed in wells, Groundwater levels can be taken automatically and stored hundreds of times a day. The main point is that weekly monitoring, as proposed in the document, is inadequate to monitor groundwater connections between the mine and discrete aquifers.

RESPONSE: The agency's analysis has concluded that there is a low probability for impacts to water resources from inflow to the underground workings. Therefore, weekly monitoring of the cluster wells is an adequate monitoring frequency.

P15-5 I question the reliability of MW-T2A, MW-11A, MW-9A and MW-20A to monitor groundwater without a review of the boring logs, screened intervals and total depth. On page 45 of the document there is no mention that the four wells "may be useful in the monitoring of groundwater". Additional wells that are useful in monitoring groundwater should be installed and monitored more frequently than monthly.
RESPONSE: Monitoring wells MW-T2A, MW-11A, MW-9A, AND MW-20A were the wells originally proposed by SMC to monitor the aquifer. Subsequently the agency decided that these wells were not adequate to monitor the vertical gradients in the aquifer that would be crucial for detecting impacts from tunnel inflows. Three cluster wells were installed and these are the wells that will be used to monitor impacts to the aquifer. Boring logs are on file with the agency for public review. Other information is on Figure 4 and in the associated text.

P15-6 A post-closure monitoring program should be agreed upon to monitor reclamation results. The post-closure monitoring program should also include citizen oversight.
RESPONSE: Monitoring of the cluster wells will continue after closure until agency hydrologists are assured long-term compliance with the Montana Water Quality Act is attained.

P15-7 The ASARCO mine near Troy had the chance to use the Rotasonic drilling technology recently. Cost was used as an excuse to switch to hollow-stem auger drilling. Drilling problems were encountered immediately at the surface which could have been avoided using the Rotasonic drill rig. A better subsurface characterization could have been achieved using appropriate technology.
RESPONSE: Thank you for your comment. See response to comment 15-1.

Jeanne-Marie Souvigney
Greater Yellowstone Coalition

P16-1 Approval of this amendment appears to allow production of unidentified and unquantified reserves, leaving the reader with no idea of the potential significance of the ore reserves, where and how much mining might occur underneath or affecting the river. The analysis seems restricted to the haulageway, but the amendment allows development at an unidentified level, and with unidentified effects.
RESPONSE: Geologic reserves extend throughout the 27 miles of reef. The thickness of the reef averages 4-10 wide. Ore reserves under the valley have not, as yet, been precisely delineated. The EIS analyzes impacts from both the haulage and potential mining close to the crown pillar. Mining that takes place well below the crown pillar will not affect the surface resources or water resources. The total quantity of ore that can be mined is limited by the size of the tailings impoundment permitted in the 2000 TPD EIS (MDSL and USFS, 1992).

P16-2 Please clarify whether this proposal, if approved, would allow only access and delineation of reserves, or would also allow potentially unlimited development of those reserves. We believe this amendment, if approved, should be restricted to development of the haulageway and

delineation of reserves, and that development of these reserves would require a new permit following analysis and identification of potential impacts.
RESPONSE: Please see Chapter I and Chapter II and response to P7-5 and 16-1.

P16-3 There is absolutely no information provided about existing conflicts with recreational traffic, nor how development of this haulageway will reduce conflicts. What is the extent and character of traffic accidents now (how often, where, of what nature, etc.), and how will this situation change under the proposal?
RESPONSE: Existing conflicts were not an issue raised during scoping. Haulage conflicts with traffic are caused by the short line-of-sight to the south and the slow speed at which haul trucks cross the road and the high speed at which some recreational vehicles travel.

Although no haul truck - public traffic accidents have occurred to date the potential does exist. Please see response to comment P1-7.

P16-4 Similarly, there is no information about costs associated with existing hauling procedures, nor how such costs will be reduced if this amendment is approved. If these results are being used as a rationale for the amendment, they must be documented. Otherwise, drop these two points.
RESPONSE: The agencies' decisions are based on environmental impacts, not on the cost to the applicant. Please see additional information provided in P16-3 above.

P16-5 Water is perhaps the overriding concern related to this amendment. Certain information on water flow, potential for water interception, and water quality should be added to the FEIS. It should include more detail on sources of information about water inflow and factors affecting predictions of inflow; existing nitrate levels and the potential for increases in nitrate levels; and potential for acid mine drainage. While you mention that some of this information is provided in the previous EIS's, it should be repeated, and at least summarized, here.
RESPONSE: Thank you for your comment. The text has been revised. The MDSL-USFS 1992 EIS provides a great deal more information including acid producing potential than was summarized in this EIS. Nitrate levels would not increase under this amendment because mining rates would not change.

P16-6 The fairly brief - and selective - table of mines operating beneath other bodies of water doesn't provide a sufficient basis for the public to evaluate potential risks of this type of development. Have other mines operated underneath bodies of water where problems resulted? What types of problems? Can they happen here?
RESPONSE: Please see response to comment P1-13. The table was not selective and was not intended to be an exhaustive review.

P16-7 This buffer zone would be maintained and excluded from the Phase II mining plan, although SMC may request that this zone be added to the mining plan. Under what conditions will SMC be allowed to mine the buffer zone, i.e., a demonstration that the two objectives identified earlier are met? How much would mining of this buffer zone likely increase the possibility of any impact? Would this request require another permit? Will there be opportunity for public review and comment?
RESPONSE: If permitted, the completion of the 4400 haulage will provide the agency with subsurface geotechnical and hydrologic data that will be used in deciding if mining in the

buffer zone is a good idea. The decision whether to mine or not in the buffer zone will be based on an evaluation of the new information and the risk to water resources. However, the crown pillar would not be mined.

P16-8 It is my understanding that the Stillwater Protective Agency has proposed a new alternative for consideration, which would allow SMC to develop new ore body access on the east side of the river, without developing a tunnel under the river. We urge you to analyze this alternative, particularly since it addresses the primary motivation for this amendment (additional access to ore reserves). As I noted earlier, the DEIS provides absolutely no documentation to support its contention that safety and haulage distance costs were motivating factors for this amendment; the primary remaining impetus - access to ore reserves - would be addressed by this alternative. Consequently, this new alternative deserves analysis and serious consideration.

RESPONSE: Please see response to comment P1-4, P 16-3 and additional information at the end of Chapter II. MEPA requires an evaluation of effect relative to concerns. It does not require the agencies to analyze SMC's motives.

P16-9 There is a section on monitoring, although the section lacks clarity on exactly what the monitoring is intended to show; it also fails to provide thresholds of when and what type of corrective actions would be taken if monitoring shows unacceptable impacts. For example, what happens (and when) if unexpected quantities of water are encountered? What if ground movements are encountered? What will you be monitoring from the existing wells and the well cluster? What do you intend when you say you will monitor vertical gradients? What does existing monitoring show?

RESPONSE: Vertical gradients are evaluated by measuring the difference in water levels in closely spaced wells that are completed at different depths in the aquifer. If these water levels change with respect to one another, then the vertical gradients in the aquifer have changed. If changes in vertical gradients in the aquifer are detected by monitoring of the cluster wells and can be tied to inflows in the mine, then SMC will be required to reduce the rate of inflows by additional grouting or installing a bulkhead. See expanded discussion in Chapter II of the EIS.

P16-10 During scoping, I again raised a concern that I have raised several times in the last few years about the lack of monitoring reports. I asked then whether the agencies intended to provide monitoring reports, now and in the future. Under separate cover, I sent a request to the state and Forest Service for monitoring information, offering to meet with the agencies if necessary. I was subsequently told that the agencies were trying to consolidate the monitoring plans adopted in the multitude of permits issued for this mine in the last ten years and that a monitoring report would be issued, but so far, I have not seen anything.

RESPONSE: The monitoring reports you are referring to are US Forest Service reports. The Forest Service indicates it is no longer funded to prepare these reports. If future budgets and staffing allow, the USFS said it would again prepare the reports you refer to. The DEQ does not have a legislative mandate or the resources to compile and distribute monitoring reports. The consolidation of monitoring plans has been delayed as a result of staffing, budgets and the urgency of other projects such as reorganization, comment hearings and scoping meetings on other EIS level projects, and preparation of special reports to legislative committees.

P16-11 This DEIS does not contain any reference to the development of a monitoring report that would be available to the public, or to any other process you might be willing to establish to allow the public to understand what previous monitoring results show.
RESPONSE: Monitoring reports are available for public review at agency offices at any time during regular hours. Previous monitoring reports are used to prepare environmental analyses such as this EIS. See also response to P16-10.

P16-12 Why haven't you, in this EIS, provided the interested public with a schedule for the consolidated monitoring plan and committed to a mechanism that would allow the public to understand the condition of their resources and the success of the mitigations measures adopted to date? Are all the existing monitoring plans being implemented as planned? Who is doing the monitoring, and are the agencies analyzing the data to assure that the terms of previous permits are being met? How will you implement and analyze newly proposed monitoring plans.
RESPONSE: Existing monitoring requirements are being implemented and agency staff are evaluating SMC's reports. These evaluations indicate the terms of previous permits are being met. Please see response to comment P16-11. Monitoring requirements are not changing; rather, a document pulling the requirements into one document is being prepared. Statutorily, this is a low priority project. If and when it is complete, it will be shared with the public and SMC.

P16-13 Annual monitoring reports, available to the public, should be an integral part of this and every other permit decision if the public is to maintain faith in the permitting process. Please address this in the FEIS.
RESPONSE: Please see response to comments P16-10, P16-11, and P16-12.

Patrick McCave
Nye, Montana

P17-1 Although tunneling under rivers, lakes and even the English Channel has been done successfully, there has also been failures, where lakes have been drained and mines have had to shut down.
RESPONSE: Please see response to comment P1-13.

P17-2 As was pointed out at the public meeting in Absarokee, this is in an earthquake zone. I believe there is a real possibility of draining the river.
RESPONSE: Please see the discussion on effects to river flow in Chapter IV. Data on geology and hydrology of the area do not support this conclusion.

F. A. Baukol
Nye, Montana

P18-1 The proposed tunnel and future mining under the Stillwater River will open up the possibility of some pollution and damage. Regardless of what anyone claims, the danger will always be there.
RESPONSE: Please see response to comment P12-2.

P18-2 The Stillwater is one of the few Rivers left that is for the most part pure and clean. Completely uncontrolled as nature intended.

RESPONSE: The Stillwater River is impacted by many nonpoint source and point source discharges. Elevated nutrient loads are the major impact on the river and result from agricultural runoff, development, and municipal discharges from sewage plants. Under water quality law, discharges from SMC are regulated to maintain all beneficial uses of the river.

P18-3 In future years the mining industry will be the cause of large trailer camps, large size septic systems, bigger and bigger holding ponds. All in the name of big business, and larger profits.
RESPONSE: No proposals to expand the mine have been submitted to the agency. Any expansion proposals will be reviewed by the agencies for compliance with applicable air, water, and socioeconomic statutes as required under the Montana Environmental Policy Act (MEPA) and other statutes.

W.Wayne Fitkin
Billings, Montana

P19 Thank you for your comments.

Keith E. Martin
Nye, Montana

P20 Thank you for your comments.

Industrial Tool & Repair
Billings, Montana

P21 Thank you for your comments.

ORAL TESTIMONY - COMMENTS AND RESPONSES FROM THE NOVEMBER 27,1995, PUBLIC MEETING IN ABSAROKEE, MONTANA

Jack Heyneman
Nye, Montana

T1-1 Another possibility if there truly is the need for a tunnel is for transport across a bridge or a conveyor belt. These are possibilities that I think deserve a little more consideration.
RESPONSE: Please see response to comments P1-4 and P6-1.

T1-2 There is one other question I would like to know. The forest service does fit into this because a lot of the land is Forest Service and I'm concerned about the cumulative impacts of this. I don't necessarily mean in a negative way.
RESPONSE: Please see response to comment P1-5 and additional text in Chapter IV.

T1-3 How does this fit into the tailing pond. How does this fit into the potential of what I've heard of the new tailing pond down the river. I wish we were looking at the full picture a little more completely.
RESPONSE: Please see response to comment P1-6 and Chapter I, Issues.

T1-4 Finally, just to be moderately inflammatory and over cautious. Just remember the old Sunshine Mine that, not too many years ago, swallowed a lake in Colorado. Things can go wrong and I think that a very serious effort has to be made to anticipate all that but I truly believe that we can't be too careful.
RESPONSE: Please see response to comment P1-13.

Jim Mulligan
Nye, Montana

T2-1 Good news from Robert Wallace, the country's foremost expert on earthquakes and a former summer resident near the mine, stated that underground workings are generally not severely affected by earthquakes as the structures built on the surface. His bad news is that the section on seismicity is essentially meaningless. But the Horseman Flat Fault near the mine should be classified as active and that there is an extremely wide range of uncertainty about seismic activity in that area. So uncertainty and the unanticipated provokes some uneasiness.
RESPONSE: Please see response to comment P2-1.

T2-2 Mining under the river following the good grade mineralization possibly upstream or downstream will surely compound the likelihood of seriousness far into the future. That's why statements in the Draft EIS such as "short time instability is unlikely" alarm me. Is unlikely good enough.
RESPONSE: The ore body trends east and west, therefore mining cannot progress up or downstream in relation to the Stillwater River.

Noel Peel
Nye, Montana

T3-1 This is a historical fault zone that we live near - the Horseman Flat fault which was mentioned by Mr. Wallace. If you read National Geographic and all that they are saying that the earthquake epicenter, the mud pots, and everything travel in this direction - they started out wide and they are going to end up in Canada somewhere. They are going right through here. So you know that we probably won't be around to see this, it is going to take another 100,000 years, but we may have an earthquake before then. So anytime you go into this faulted area knowing at some point in time down the line we are going to have an earthquake I can foresee a real problem with the Stillwater River.
RESPONSE: Please see response to comment P2-1.

T3-2 Another problem that I think is not addressed well enough is right now they are getting according to some of the people at the mine about 1,000 gpm of water out of the mine itself and this is tainted nitrate water that has been run through the blast rock. Now they predict that they are going have about another 300 gpm above and beyond that in the rest of the proposal. I think that is very optimistic. I hope that is all they get.
RESPONSE: Please see response to comment P11-3.

T3-3 We have already seen the results of trying to tunnel under Spring Creek or No Name Creek. It used to run down through John Mouat's property which now belongs to Stillwater Mine as a result of that. I am not sure if they are prepared to file on all the landowners up and down the river.

RESPONSE: Please see response to comment P1-17.

Norm Hiett
Billings, Montana

T4-1 Thank you for your comments.

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GLOSSARY

Alluvium - Unconsolidated materials deposited by streams.

Crown Pillar - The mass of rock that overlies underground workings.

Dike - A tabular igneous intrusion that cuts across the bedding of the local rock.

Drift - A horizontal underground opening driven along an ore vein.

Footwall - The underlying side of an orebody.

gpm - Gallons per minute

Hangingwall - The overlying side of an orebody.

Haulage - A tunnel used for transporting ore or waste rock.

Permeability - The capacity of a rock, sediment or soil to transmit water.

Portal - The mouth of an adit or tunnel.

Raveling - Rock fall from the roof or sides of underground workings.

Reef - A common term for a tabular ore deposit enclosed in rock of differing composition.

Shaft - A vertical excavation through which a mine is worked.

Stope - An underground excavation formed by the extraction of ore.

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